DIRECT TESTIMONY OF
STEVEN P. HARRIS
ON BEHALF OF
SOUTH CAROLINA ELECTRIC & GAS COMPANY
DOCKET NO. 2012-218-E

Q. PLEASE STATE YOUR NAME AND BUSINESS ADDRESS.

A. My name is Steven P. Harris. My business address is EQECAT, Inc. ("EQECAT"), 475 14th Street, Oakland, California 94612.

Q. WHO IS YOUR EMPLOYER AND WHAT IS YOUR POSITION?

A. I am a Vice President with EQECAT, Inc., a subsidiary of the ABS Group of Companies, Inc. Together these two companies are leading global providers of catastrophic risk management services, including software and consulting, to major insurers, reinsurers, corporations, governments and other financial institutions. In addition, these companies develop and license catastrophic underwriting, pricing, risk management and risk transfer models that are used extensively in the insurance industry. The companies provide the financial, insurance and brokerage communities with a science and technology-based source of independent quantitative risk information.

Q. PLEASE DESCRIBE YOUR EDUCATIONAL BACKGROUND AND BUSINESS EXPERIENCE.

A. I hold Bachelors and Masters degrees in engineering from the University of California at Berkeley. I am a licensed civil engineer in the State of California. Over the past 30 years, I have conducted and supervised independent risk and financial studies for public utilities, insurance companies and other entities, both regulated and unregulated. My areas of expertise include natural hazard risk analysis, operational risk analysis, risk profiling and financial analysis, insurance loss analysis, loss prevention and control, business continuity planning, and risk transfer.

A significant portion of my consulting experience has involved the performance of multi-hazard risk studies, including earthquake, ice storm and windstorm perils, for electric, water and telephone utility companies, and insurance companies.

I have performed or supervised hurricane, and ice storm loss and solvency analyses for utilities including South Carolina Electric & Gas Company, Tampa Electric, Florida Power & Light, Progress Energy Florida, Gulf Power Company, B.C. Hydro, Kentucky Utilities, and others. Additionally, I have performed loss analyses for earthquake hazard for utilities including the Los Angeles Department of Water and Power, the California-Oregon Transmission Project, Sacramento Municipal Utilities District, and others.

For energy companies and insurers that have exposures in a wide array of geographic locations, I have performed or supervised multi-peril analyses for all natural hazards, including earthquakes, tsunami, riverine flood, storm surge, windstorms and ice storms.

Q. HAVE YOU PREVIOUSLY PROVIDED TESTIMONY TO THIS OR OTHER PUBLIC SERVICE COMMISSIONS REGARDING STORM RISKS?

A. I have not appeared before or provided testimony to the Public Service Commission of South Carolina (the "Commission"). I have provided testimony to the Florida Public Service Commission in proceedings for Florida Power and Light, Progress Energy Florida, and Tampa Electric Companies.

Q. WHAT IS THE PURPOSE OF YOUR TESTIMONY?

A. The purpose of my testimony is to present the results of the EQECAT hurricane, tropical and ice storm analyses performed on behalf of SCE&G. My testimony also provides quantitative metrics to assess the impact of reinstating collection for the reserve at $6.1 million per year in light of the wind and ice perils faced by the SCE&G T&D system.

Q. ARE YOU SPONSORING EXHIBITS IN THIS CASE?

A. Yes. I am sponsoring the following exhibits: Exhibit No. ___ (SPH-1) – Hurricane, Tropical, and Ice Storm Loss and Reserve Performance Analysis and Exhibit No. __(SPH-2) which consists of charts and slides to illustrate my testimony.

Q. PLEASE BRIEFLY DESCRIBE THESE STUDIES PERFORMED FOR THE COMPANY.

A. EQECAT performed two analyses relative to the storm reserve: The Storm Loss Analysis, and The Storm Reserve Performance Analysis. The Loss Analysis is a probabilistic storm analysis that uses proprietary software to develop an estimate of the expected annual amount of uninsured windstorm damage to which SCE&G is exposed.

The Reserve Performance Analysis is a dynamic financial simulation analysis that evaluates the performance of the storm reserve and the likelihood of adequate reserve over a five year period, given the potential damage determined from the Storm Loss Analysis, for various conditions of accrual, insurance levels, and other factors.

Q. PLEASE SUMMARIZE THE RESULTS OF YOUR ANALYSES.

A. The Storm Loss Analysis estimated that the total expected annual damage (EAD) to SCE&G's system from all wind and ice storms is $21.6 million. Storm damage includes costs associated with service restoration and repair of SCE&G's T&D system as a result of hurricanes, tropical storms and ice storms. All of the $21.6 million EAD would not be an obligation to the storm reserve. Non-capital storm costs above ordinary O&M levels are considered to be storm reserve obligations. Reserve obligations are assumed to be 46.8% of the total EAD, based on the experience from Hurricane Hugo, and costs in excess of $2.5 million per year. This represents an EAD of about $7.8 million that is assumed to be an obligation of the reserve. The current amount of the storm reserve is approximately $30.1 million. The Storm Loss Analysis found a probability of 9% per year that storm damage will exceed $30 million, about a one in ten likelihood that storm cost will exceed the available storm reserve each year.

The Reserve Performance Analysis simulates the performance of the reserve over a prospective five year period. The simulation of the current reserve conditions demonstrated that, assuming there are no annual accruals, $70 million in insurance for single hurricane damage in excess of $100 million, and that any negative storm reserve amount would be recovered over a period of five years, there would be an expected storm reserve of negative ($7.2 million) at the end of the five-year simulation time horizon and a probability of inadequate reserves of 52% over this period.

A similar analysis, assuming the annual reserve accrual of $6.1 million is reinstated, $70 million in insurance for hurricane with damage in excess of $100 million, and that any negative storm reserve amounts would be recovered over a period of five years, found that there would be an expected storm reserve of a positive $20.6 million at the end of the five-year simulation time horizon and a probability of 28.9% of inadequate storm reserves over this period. Both five year ending reserve amounts are less than the current $30.1 million.

Q. PLEASE DESCRIBE THE COMPUTER SIMULATION MODEL USED TO PERFORM THE HURRICANE LOSS ANALYSIS.

A. USWind™ is a probabilistic model designed to estimate damage and losses due to the occurrence of hurricanes. EQECAT proprietary computer software USWind is one of only four models evaluated and determined acceptable by the Florida Commission on Hurricane Loss Projection Methodology (FCHLPM) for projecting hurricane loss costs. The expected annual damage is computed simulating thousands of storm damage events in the EQECAT storm model. Annual damage estimates are developed for SCE&G asset locations and aggregated, to an overall portfolio damage amount. USWind's climatological models are based on the National Oceanic and Atmospheric Administration (NOAA) and the National Weather Service (NWS)Technical Reports. For example, climatological probability distributions (i.e., for storm parameters) were developed using an Adaptive Kernel Smoothing technique applied to historical hurricane records published by NOAA. The Storm Loss Analysis is based on the storm frequency and severity distributions developed from the long historical record and includes the possibility of having multiple storms within South Carolina within a given year.

Q. HOW MANY POSSIBLE WIND STORMS DID YOU ANALYZE USING THIS MODEL?

A. EQECAT's North Atlantic Hurricane Model is a probabilistic model that uses the National Hurricane Center's HURDAT data set from 1900 to 2008, with 2009 additionally included. Its robust probabilistic set includes approximately 128,000 events. These events cover gaps in the historical data set to provide a consistent, credible, and realistic view of hurricane risk, particularly for low-probability, high-consequence events. The probabilistic set is evaluated against the historical data set for completeness and validation.

Q. HOW DID YOU CONDUCT YOUR ANALYSIS OF SCE&G'S EXPOSURE TO DAMAGE FROM ICE STORMS?

A. We conducted a similar analysis for ice storms using the EQECAT WinterStorm™ model. EQECAT's USWinterStorm model is a probabilistic model based on the National Weather Service, NOAA Solar and Meteorological Surface Observation Network (SAMSON), and the United States Historical Climatology Network (HCN) historical data. To capture the complexity and variability of winter storms, stochastic perturbation technique has been used to develop the EQECAT stochastic event set. The footprint of each historical event has been reconstructed using measured historical hazard parameters. It is a robust probabilistic event set that includes thousands of events. The winter storm parameters related to transmission and distribution damage are ice thickness, and sustained wind. A state-of-the-art flux model has been used by EQECAT to estimate ice thickness in winter storms. The model has been adopted by the American Society of Civil Engineers (ASCE) to develop the mapping of extreme ice loads in the United States for the revision of the ASCE-7 (Minimum Design Loads for Buildings and Other Structures). It provides credible coverage of the winter storm hazard in the U.S. Hazard maps produced from the stochastic event set has been compared favorably with historical maps and the hazard maps used for building design code provided by the ASCE.

Q. EXPLAIN WHY IT IS NECESSARY TO USE MODELING IN THESE ANALYSES.

A. Hurricanes, tropical storms, and ice storms are events that have low probabilities of occurrence in any given year, but can have high-consequence for a T&D systems like SCE&G's. Because of the infrequent nature of such events, actual loss events to SCE&G system do not provide adequate data to reliably estimate expected annual losses. The insurance industry uses simulation models to quantify such risks and this approach is accepted as the standard method in the industry for estimating expected losses over time. The EQECAT models are utilized to provide decision quality risk information in the insurance and insurance industries, as well as by risk managers in industry and government.

Q. DID THE LOSS ANALYSIS INCLUDE A PROJECTION FOR FUTURE INFLATION OR FUTURE SYSTEM GROWTH?

A. No. The Storm Loss Analysis is performed for a one year period and conservatively assumes no future asset growth or inflation. It is a snapshot of SCE&G's current assets. Given conservative assumptions about system growth and inflation, the storm damage estimates may be systematically biased toward low values. The uncertainties represented by these assumptions are within the overall uncertainties of the storm hazards.

Q. WHAT DOES THIS EXPECTED ANNUAL LOSS ESTIMATE REPRESENT?

A. The expected annual damage represents the average annual cost associated with damage to transmission and distribution assets, and service restoration activities resulting from windstorms over a long period of time.

Q. **IS THE LOSS ANALYSIS PERFORMED FOR SCE&G THE SAME ANALYSIS PERFORMED FOR INSURANCE COMPANIES TO PRICE AN INSURANCE PREMIUM?**

A. Yes. The natural hazards loss modeling and analysis would be similar for an insurance company, electric utility, or other entity. The expected annual damage is also known as the “Pure Premium,” which when insurance is available, is the insurance premium level needed to pay just the expected losses. Insurance companies add their expenses and profit margin to the Pure Premium to develop the premium charged to customers.

In 2007 SCE&G obtained a $70 million insurance policy to transfer risk of high levels of damage to its transmission and distribution systems from named hurricanes calculated to exceed $100 million. This insurance specifically relies on the EQECAT USWind model to compute modeled loss for storm events with simulated size, intensity, speed, track and landfall location equivalent to those of an actual storm. Payment of any claim is based upon the results of the modeling for the hurricane that caused the claim.

Q. WHY ARE STORMS OF CONCERN IN THIS PROCEEDING?

A. Electric system repair and service restoration after major windstorms and ice storms can require utilities to spend hundreds of millions of dollars. There are several ways to pay for such costs. One is a regulatory-created storm damage reserve. SCE&G has such a reserve which was established by the Commission in Order No. 1996-15. As of July 2012, the reserve was approximately $30.1 million. Collection for the reserve through rates has been suspended since 2010 by virtue of Order No. 2010-471. The Application in this proceeding seeks reinstatement of the collection for the storm damage reserve and indicates, if reinstated, the collection would generate approximately $6.1 million per year.

Q. WHAT WAS THE CONCLUSION OF THE STORM LOSS ANALYSIS?

A. Our Storm Loss Analysis determined that the EAD expected on SCE&G's system from hurricanes, tropical storms and ice storms was $21.6 million. This EAD was composed of estimated annual damages from hurricanes, tropical storms, and ice storms of $8.9 million, $2.6 million, and $10.1 million respectively.

This analysis showed that SCE&G's system could expect to experience ice storms more frequently than major hurricanes, but the ice storms resulted in lower damage levels than major hurricane landfalls on the South Carolina coast. The 100-year modeled ice storm damage is only two-thirds as large as the 100-year hurricane damage.

Q. DOES THE EXPECTED ANNUAL DAMAGE MEAN THAT SCE&G CAN EXPECT TO SUSTAIN DAMAGE AT THAT LEVEL EACH YEAR?

A. No. The EAD is the average annual storm damage over a long period of time. Storms can be quite variable with some years having no damage and others having large to catastrophic damage. This EAD represents the average annualized costs of many storm seasons, of different locations, paths, speeds and intensities, over a very long period of time.

Q. HAS SCE&G SUSTAINED LOSSES AT THIS LEVEL IN RECENT YEARS?

A. No. In recent years, SCE&G has experienced a very favorable storm history. The recent storm damage experienced has been less than the long term average annual damage.

Q. IS SCE&G'S RECENT STORM DAMAGE HISTORY INDICATIVE OF ITS ACTUAL EXPOSURE TO FUTURE STORM DAMAGE?

A. No. SCE&G's recent history of storm damage is not at all indicative of its actual exposure to future storm damage. Given the highly variable nature of such storms, periods of lower than average loss experience are expected and consistent with the nature of the risk. SCE&G's territory has experienced significant storms in the past. The fact that SCE&G has not experienced such storms over the past several years is no basis to conclude that it will not experience them in the future. Only by looking at periods of time much greater than even twenty years can an accurate measure of annual risk be estimated. Over a long period of time, SCE&G's average losses from wind and ice storms will be much greater than the short recent favorable experience has been.

Q. PLEASE EXPLAIN THE ANALYSIS YOU CONDUCTED CONCERNING SCE&G'S EXPOSURE TO STORM DAMAGES AND THE PERFORMANCE OF ITS STORM DAMAGE RESERVE.

A. The EQECAT Storm Reserve Performance Analysis is a dynamic financial simulation analysis of the impact of the estimated storm losses on the SCE&G storm reserve for specified levels of annual accruals, insurance and other parameters over a multi year period. The starting assumption for the analysis was a storm reserve amount of approximately $30.1 million. The reserve is assumed to provide for 46.8% of the EAD of $21.6 million per year. This is consistent with the regulatory costs to the reserve experienced in Hurricane Hugo.

Under the storm damage reserve established for SCE&G in Order No. 1996-15, storm impacts are not paid out of the reserve until they exceed $2.5 million aggregate for the calendar year. EQECAT's analysis excluded individual hurricanes, tropical storms, and ice storms with damage to SCE&G's transmission and distribution assets that exceeded $2.5 million. We applied this $2.5 million threshold on a storm-by-storm basis, which means that our analysis understates claims on the reserve to the extent that multiple smaller storms might cumulatively exceed $2.5 million in a given year. This condition has occurred in past years on SCE&G's system and is likely to occur in the future. This $2.5 million retention further reduces the portion of the total expected annual damage of $21.6 million that is assumed to be an obligation of the reserve. For the current reserve, with insurance in force, the 46.8% and a $2.5 million per occurrence reduction represents $7.8 million in EAD.

Q. PLEASE DESCRIBE YOUR FINANCIAL SIMULATION MODEL OF THE STORM RESERVE?

Our Reserve Performance Analysis used a technique called "Monte Carlo" analysis that performs 10,000 simulations of wind and ice storm damage, each covering a five-year period, to determine the effect of the storm charges for damage on the storm reserve. We modeled the performance of the reserve both with and without the assumption that collection for the reserve is reinstated.

Monte Carlo analysis is a technique used to model multiple storm seasons and simulate variable storm damage consistent with the results of the Storm Loss Analysis. Monte Carlo simulations were used to generate loss samples consistent with the expected annual damage that is assumed to be the reserve obligation. For the case where insurance is in effect, this represents an annual damage of $7.8 million that is assumed to be the obligation of the reserve. The analysis provides the expected amount and other measures of the storm reserve performance in each year of the simulations accounting for the current amount, annual accrual, insurance, and losses using a financial model.

For modeling purposes, we assumed that when the amount became negative, the Company would recover the negative amounts over five years through some form of storm damage recovery mechanism such as special assessment to customers.

We provide three values that characterize the results of 10,000 simulations for each five year analysis. The mean probability shows the average or expected amount in the reserve based on the results of all reserve simulations. The 5th percentile of the reserve amount (i.e., 5% of the 10,000 simulations are smaller than the 5th percentile value). The analysis shows that in any given year there is only a 5% likelihood that the amount in the storm damage reserve would be less than (more negative) the amount shown at the 5th percentile. Finally, we present the 95% percentile for the reserve amount (i.e., the amount reflects very small, or no storm damage over the simulation). The 95th percentile value indicates that storm reserves would be lower than this amount in 95% of the 10,000 simulations.

The analyses also estimate the likelihood that the reserve will be inadequate to cover the storm losses in any year of the simulation. Similarly, the analyses report the likelihood that the reserve will exceed $50 million at the end of the five year simulation.

Q. WHAT DID YOUR ANALYSIS SHOW WITH RESPECT TO THE CURRENT RESERVE POLICIES?

A. The results of the case reflecting current reserve policies, with no annual accrual, $70 million in insurance in excess of $100 million damage, and recovery of negative amounts over five years, the likelihood of inadequate reserves occurring in any year over a five-year simulation time horizon is 52%, or a one in two likelihood. The expected amount of the storm reserve at the end of five years would be a negative ($7.2 million). The 5th percentile amount would be negative ($65.9 million).

A result of a similar analysis was performed assuming that an annual accrual level of $6.1 million is reinstated, shows the expected amount of the storm reserve at the end of five years would be $20.6 million. The probability that the reserve is inadequate over five-years is 28.9%, a reduction in likelihood to less than one in three. The 5th percentile amount would be negative ($42.8 million), or a reduction of $23.1 million in potential catastrophic exposure as compared to the similar figure from the prior case. There is a 23 % chance that the reserve at the end of five years could exceed $50 million. This would represent a series of five year storm histories that have very small amounts of damage paid from the reserve.

Both analyses show a decline in the reserve at the end of five years. With a $6.1 million accrual reinstated the reserve amount will remain positive at about two thirds of its current value.

Q. DESCRIBE THE CONSERVATISMS IN YOUR MODELS AND ANALYSES?

A. SCE&G has only experienced one catastrophic storm over the past two and a half decades, Hurricane Hugo in 1989. The assumption used in our analysis was that the experience from Hurricane Hugo regarding storm restoration costs that are attributable to the reserve are applicable to all hurricanes, tropical storms and ice storms. The storm restoration process is different for every storm event. Many factors can affect storm restoration and the costs that may be obligated to the reserve. Experience from other utilities suggests that the Hurricane Hugo percentage of costs may be low and not be representative of all future storms SCE&G may experience.

We also included in the analysis damage related to tropical storms which were not included in prior analyses we have done for the Company. SCE&G's T&D system has in fact experienced losses from such storms at levels that exceed the $2.5 million annual threshold and we expect that SCE&G will experience damages from such storms in the future. We did not include losses for other types of windstorms, such as non-tropical storm systems, including tornados. However, SCE&G has experienced damage from such storms and that would impact the reserve where the annual $2.5 million threshold is met.

Not considering costs associated with windstorms other than hurricanes and tropical storms and not cumulating damages from storms costing less than $2.5 million on an annual basis makes our EAD number conservative as a measure of the level of likely claims on the storm damage reserve. For these reasons, the EAD very likely understates the claims on the storm damage reserve that SCE&G will experience over time.

Q. ARE YOU PRESENTING OTHER EXHIBITS?

Yes. For illustrative purposes, I have included a NOAA summary of historical hurricanes Category 3 and greater. It is attached as Exhibit No. ___ (SPH-2).This data shows that the coastal areas of South Carolina are vulnerable to large hurricanes. This data also shows the variable nature of the occurrence of such storms and the fact that such storms occur in cycles characterized by active and inactive periods which can last for decades as well as temporal clustering.

The EQECAT model calculated the costs and probabilities of thousands of individual storms, storm tracks and storm intensities that might impact SCE&G's service territory. Exhibit No. __ (SHP-2) shows, for example, the potential impacts to SCE&G storm reserve of Category 3 and 4 storms making landfall within 10-mile bands of the South Carolina coast from Georgia to just below the North Carolina line. As indicated there, such storms could produce total damage in the range of approximately $20 to $300 million and obligations of the reserve in the range of approximately $15 million to $140 million. The most damaging storms are hurricanes that make landfall near Beaufort and whose northern arm sweeps through the Charleston, Orangeburg and Columbia areas.

In addition, the study shows that current customers are benefiting from a favorable short-term storm experience that is lower than average. The study shows that this is not likely to remain the case over the long-term and that in the future the system is likely to experience higher loss levels. The EAD represents a conservative measure of the amount of money that SCE&G needs to generate each year to cover the damage that it is likely to sustain over the long-term from storms costing more than $2.5 million.

Q. WILL THE RESERVE BE ADEQUATE FOR ALL STORMS?

A. No. Our analysis shows that if a major hurricane makes landfall on the southern or central South Carolina coast, the reserve, while it will be useful in defraying some of the costs, will be quickly exhausted. The current reserve of $30.1 million is sufficient to cover some, but not all single category 3 storms. For Category 3 storms, the reserve will only cover a portion of the damage. For Category 4 storms with $100 million or more in damage, the insurance policy will attach and provide up to $70 million, but there is likely to be a gap between the reserve amount, and the level of damage for all but the most damaging events. On the other hand, our analysis shows that SCE&G's territory is also subject to frequent but smaller impacts from major hurricanes that do not hit the South Carolina coast directly. The system is subject to damage from direct hits by smaller hurricanes and tropical storms, and damage from ice storms. At the proposed levels of reinstated collections, the reserve will likely be able to meet the costs of many of these lower-consequence storms thus limiting the number of times that SCE&G will be required to come to the Commission for ex post facto cost recovery due to storm damage. With a lower reserve, even a series of smaller storms might be sufficient to exhaust the reserve if they occurred in a relatively short period of years.

Q. WHAT DOES YOUR STUDY SHOW REGARDING SCE&G'S STORM DAMAGE AND REINSTATING COLLECTION FOR THE STORM DAMAGE RESERVE?

A. From the perspective of expected future losses, SCE&G'S request to reinstate collections for the storm reserve, as proposed in the Company's Application, would change the projected depletion of the reserve. The reinstatement of the reserve collection will reduce from one in two, to one in three the likelihood of the reserve being inadequate. The reserve collections of $6.1 million is close to, but less than, the annual damage obligation of the reserve. With the proposed collections, the reserve is expected to gradually decline, but the collections will reduce the frequency of storm by storm damage cost recoveries due to inadequate reserves, and tend to enhance rate stability.

Q. DOES THIS CONCLUDE YOUR DIRECT TESTIMONY?

A. Yes.

Exhibit No.:____________
Exhibit SPH1

South Carolina Electric & Gas

Hurricane, Tropical and Ice Storm Loss and Reserve Performance Analyses




September 2012

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Executive Summary

OVERVIEW OF STUDY

On behalf of SCE&G, EQECAT, Inc. has analyzed the exposure of SCE&G's transmission and distribution ("T&D") assets to damage from hurricanes, tropical storms, and ice storms. EQECAT has also assessed the expected performance of the SCE&G storm reserve to pay for the cost of these potential future losses.

The expected annual damage (EAD) to SCE&G's T&D assets from hurricanes, tropical storms, and ice storms, combined over a long period of time, is estimated to be $21.6 million per year.

Hurricane Damage

Key study conclusions related to hurricane risk are as follows:

- SCE&G's T&D assets are most vulnerable to hurricanes making landfall between Hilton Head and Charleston.
- The average damage from single Category 3 hurricane events making landfall in that area ranges from $20 million to $135 million.
- The average damage from single Category 4 hurricane events making landfall in that area ranges from $50 million to $300 million.
- SCE&G has an 8.6% chance per year of experiencing hurricane damage to T&D assets of $30 million or more.
- SCE&G has a 2% chance per year of experiencing hurricane damage to T&D assets of $100 million or more.
- The expected average damage to SCE&G T&D assets from hurricanes over a long period of time is estimated to be $8.9 million per year.

Ice Storm Damage

Key study conclusions related to ice storm risk are as follows:

- Ice storm damage is likely to be more frequent within SCE&G's system than hurricane damage.
- SCE&G has a 14% chance per year of experiencing ice storm damage to T&D assets of $2.5 million or more.
- SCE&G has a 10.5% chance per year of experiencing ice storm damage to T&D assets of $30 million or more.
- While ice storms causing more than $100 million in damage are possible, the chance of that occurring in any given year is only 1.1%.
- The expected average damage to SCE&G T&D assets from ice storms over a long period of time is estimated to be $10.1 million per year.

Storm Reserve Performance

The Reserve Performance Analysis simulates the performance of the reserve over a prospective five year period. The simulation analyzed the current reserve conditions assumes there are no annual collections, $70 million in insurance for single hurricane damage in excess of $100 million, and that any negative storm reserve amounts would be recovered over a period of five years. A similar case assuming that an annual collection of $6.1 million is reinstated was also analyzed. Key study conclusions related to the expected performance of SCE&G's storm reserve are as follows:

- Of the $21.6 million total EAD, $7.8 million is estimated to be the obligation of the reserve. This amount assumes that 46.8% of the total EAD, the non capital storm costs above ordinary O&M levels, and a deductible of $2.5 million per year are considered to be storm reserve obligations.
- The $7.8 million EAD payable from the reserve is greater than the $6.1 million per year of annual collections for the reserve. As a result, in both the cases analyzed, the reserve can be expected to be depleted over time.
- There is a 52% chance that the reserve will be fully depleted within five years with the current insurance and no collections, and a 29% chance the reserve will be fully depleted for the case with the collection reinstated.
- The analyses with the current insurance and no collections showed that the 5th percentile of the reserve amounts, or one-twentieth of the simulation outcomes, would be a negative ($66 million) during a five years prospective period. The similar case with collections had a 5th percentile amount of negative ($43 million).

HURRICANE, TROPICAL, AND ICE STORM LOSS ASSESSMENT

EQECAT considered four basic elements in modeling the risk of hurricanes, tropical storms, and ice storms to SCE&G's T&D assets:

- **Assets at risk:** First, SCE&G determined the replacement cost of T&D assets and mapped the location of those assets.
- **Loss Perils**: EQECAT used its proprietary storm damage models to simulate thousands of possible hurricanes and ice storms that could affect SCE&G's assets. These models calculated the probabilities of each of these potential storms occurring in any given year.
- **Asset vulnerabilities:** The EQECAT models evaluated the vulnerability of SCE&G's T&D assets to damage from simulated wind and ice events.
- **Portfolio Damage and Loss:** Lastly, this peril and vulnerability information is used to estimate the expected damage to SCE&G's asset from thousands of simulated hurricanes and ice storms.

From this analysis, a probabilistic database of hurricane, tropical, and ice storm losses was developed. The anticipated frequencies and expected damage to SCE&G's assets for all storms were combined to calculate the expected annual damage and annual aggregate damage exceedance probabilities for SCE&G's system. The results of these analyses are summarized in Table ES-1a below.

Table ES-1a
SCE&G Transmission and Distribution Risk Profile

ASSETS	Transmission and distribution assets consisting of: transmission structures, and conductors; distribution poles, transformers, conductors, lighting and other miscellaneous assets		
LOCATION	All T&D assets located within the State of South Carolina		
ASSET VALUE	Normal replacement value is approximately $3.2 billion, of which approximately half is transmission and half is distribution		
LOSS PERILS	Hurricanes (SSI 1 to 5), Tropical Storms, and Ice Storms		
	Hurricane	**Tropical Storm**	**Ice Storm**
EXPECTED ANNUAL DAMAGE	$8.9 million	$2.6 million	$10.1 million
10% AGGREGATE DAMAGE EXCEEDANCE VALUE	$25 million	$ 18 million	$31 million
5% AGGREGATE DAMAGE EXCEEDANCE VALUE	$51 million	$15 million	$51 million
1% AGGREGATE DAMAGE EXCEEDANCE VALUE	$148 million	$51 million	$103 million

The **Loss Perils** considered are SSI-Category 1-5 hurricanes, tropical storms, and ice storms. These events were chosen because they represent the recurring weather events that have the potential to cause major damage to the SCE&G T&D system. As discussed below, the National Oceanographic and Atmospheric Administration and other experts have concluded that the South Atlantic region is in a period of heightened hurricane formation. The study is based on hurricane frequencies and intensities consistent with this view.

The **Expected Annual Damage,** or EAD, is the estimated annual cost of restoring service, given storm damage, averaged over a long period of time. The EAD from hurricanes, tropical, and ice storms is estimated to be $21.6 million. Wind and ice storms can be catastrophic but infrequent events. The EAD is an average of all storm damage over many years and is not expected to occur every year.

The **Aggregate Damage Exceedance Value** is the likelihood of damage to SCE&G's T&D assets exceeding the given value from storms in a year. The results of the analyses for all storm perils are presented in Table ES-1b, which shows the aggregate damage exceedance probability for damage levels between zero and $200 million dollars.

- The **10% Aggregate Damage Exceedance Value** indicates that there is a 10% chance each year (one-in-ten) that SCE&G's T&D damage from all three perils will exceed $60 million.
- The **5% Aggregate Damage Exceedance Value** indicates that there is a 5% chance each year (one-in-twenty) that SCE&G's T&D damage from all three perils will exceed $90 million.
- The **1% Aggregate Damage Exceedance Value** indicates that there is a 1% chance each year (one-in-one hundred) that SCE&G's T&D damage from all three perils will exceed $186 million.

Table ES-1b

SCE&G T&D ASSETS
AGGREGATE TOTAL DAMAGE EXCEEDANCE PROBABILITIES
HURRICANE, TROPICAL STORM, AND ICE STORM HAZARDS

Damage Level	**1 Year**
($)	**Exceedance Probability**
≥ 2,500,000	60.5%
20,000,000	30.6%
30,000,000	17.0%
60,000,000	10.0%
80,000,000	6.22%
100,000,000	4.04%
120,000,000	2.74%
140,000,000	1.94%
160,000,000	1.43%
180,000,000	1.08%
200,000,000	0.83%

ANALYSIS OF THE STORM RESERVE PERFORMANCE

The second part of the study evaluates how SCE&G's storm reserve can be expected to perform when subjected to the estimated annual storm damage, and various strategies over a prospective five year period. SCE&G's storm reserve represents a source to pay for future storm damage costs.

Thousands of combinations of ice storms, tropical storms, and hurricanes could occur during any given five-year period. For that reason, the Reserve performance evaluation relies on what is known as Monte-Carlo analysis. In this analysis, 10,000 individual 10-year hurricane and ice storm loss simulations are performed for SCE&G's Reserve. These analyses used the results of the single year storm damage assessment model, discussed above, and reflected the derived damage probabilities in each year of the five year reserve performance simulation. When modeled storm damage exceeded the $2.5 million deductible in any year, the appropriate amount of loss was charged to the Reserve. Annual collections for the reserve were taken as positive accumulations to the account. The value of SCE&G at-risk assets was similarly increased 5% per year to reflect both inflation in replacement costs and expansion of the T&D system to support customer growth in SCE&G's territory. The analyses assumed a starting amount in the reserve of $30.1 million.

The analyses considered various reserve administrative policies for collections, and insurance. Two cases were analyzed. They include the current SCE&G conditions of no collection, $70 million in insurance for losses in excess of $100 million and recover of negative amounts. The second case analyzed considers the reinstatement of an annual collection for the reserve of $6.1 million per year, $70 million insurance in excess of losses of $100 million, and recovery of negative amounts over 5 years.

The results of these analysis cases are shown in table ES-1b below.

The analysis, of the current reserve conditions with no collection, $70 million insurance for damage in excess of $100 million, and assuming that negative amounts were recovered over a five year period, showed that there was a 52% likelihood that the reserve would not be able to meet storm damage obligations during the five year simulation. The average or expected amount of the 10,000 simulations indicated that at the end of five years, the reserve amount would be a negative ($7.2 million).

The similar analyses including a $6.1 million annual collections, and $70 million of insurance, and assuming that negative amounts were recovered over a five year period, showed that there was a 29% likelihood that the reserve would not be able to meet storm damage obligations during the five year simulation. The average or expected amount at the end of five years, the reserve amount would be a positive $20.6 million.

Table ES-1c
SCE&G Storm Reserve Performance

RESERVE PERFORMANCE ANALYSES RESULTS				
Analysis Case		**Expected Amount at 5 years ($M)**	**5th%ile Amount at 5 years($M)**	**Probability of insufficient reserves within 5 years**
1	No Collection $70 million insurance 5 year recovery	($7.2)	($65.9)	52%
2	$6 million Collection $70 million insurance 5 year recovery	$20.6	($42.8)	29%

1.0 Hurricane and Tropical Storm Loss Analysis

The assets of SCE&G's transmission and distribution operations are exposed to and in the past have sustained damage from hurricanes. The exposure of these transmission and distribution assets to hurricane damage is described and potential losses are quantified. EQECAT developed damage estimates for possible hurricane events using an advanced computer model simulation program USWIND™ developed by EQECAT, Inc., an ABS Group company. Hurricane damage is simulated using USWIND, and data provided by SCE&G.

Loss Estimation Methodology

The basic elements of the hurricane loss analysis include:

- **Assets at risk:** define and locate
- **Define the hazard**: apply probabilistic hurricane model for the region
- **Asset vulnerabilities:** severity (wind speed) versus damage
- **Portfolio Damage:** probabilistic analysis -damage/ loss

This portfolio risk analysis process is idealized in Figure 1-3.

These analyses take into consideration historical experience as well as meteorological, topographical, valuation, and structural data provided by SCE&G or otherwise available to EQECAT. The actual damage and financial consequences caused by a hurricane will vary according to the precise nature of the event and many variables including the storm severity and location, actual asset vulnerabilities, cost and time required to repair and restore electrical service which may cause the actual losses to differ from those estimated in this report.

Transmission and Distribution Assets

The distribution and transmission asset replacement values provided by SCE&G are approximately $3.2 billion. Transmission and distribution asset values are shown by County in Figure 1-2.

Hurricane Exposure

The historical record for hurricanes on the Gulf and Atlantic coasts of the United States consists of approximately 110 years for which reasonably accurate information is available. Going back further, written descriptions of storms are available, but it becomes increasingly difficult to estimate actual storm intensities and track locations in a reliable manner consistent with the later data. For this reason all hypothetical storms used in this analysis, as well as their corresponding frequencies, have been based only on hurricanes that have occurred since 1900.

Since the historical record is too sparse to simply extrapolate future hurricane landfall probabilities, a series of hypothetical storms was generated in the USWIND™ probabilistic storm data base, essentially "filling in" the gaps in the historical data. This provides an estimate of future potential storm locations (landfall), track, severity and frequency consistent with the observed historical data.

EQECAT developed its hurricane model (Reference 1), using the National Oceanic and Atmospheric Administration (NOAA) model as the base, to determine individual risk wind speeds. The NOAA model was designed to model only a few specific types of storms. While the eye of the hurricane follows the selected track, the EQECAT model uses up to a dozen different storm parameters to estimate wind speeds at all distances away from the eye.

The hurricane exposure is analyzed using a probabilistic approach, which considers the full range of potential hurricane characteristics and corresponding losses. Probabilistic analyses identify the probability of damage exceeding a specific dollar amount. USWIND™ is a probabilistic model designed to estimate damage and losses due to the occurrence of hurricanes. EQECAT, Inc. proprietary computer software USWIND is one of only four models evaluated and determined acceptable by the Florida Commission on Hurricane Loss Projection Methodology (FCHLPM) for projecting hurricane loss costs.

The historical annual frequency of hurricanes has varied significantly over time. There are many causes for the temporal variability in hurricane formation. While stochastic variability is a significant factor, many scientists believe that the formation of hurricanes is also related to climate variability.

One of the primary climate cycles having a significant correlation with Hurricane activity is the Atlantic Multidecadal Oscillation (AMO). It has been suggested that the formation of hurricanes in the Atlantic Ocean off the coast of Africa is related to the amount of rainfall in the Western African Sahel region. Years in which rainfall is heavy have been associated with the formation of a greater number of hurricanes. The AMO cycle consists of a warm phase, during which the tropical and sub-tropical North Atlantic basins have warmer than average temperatures at the surface and in the upper portion relevant to hurricane activity, and a cool phase, during which these regions of the ocean have cooler than average temperatures. In the period 1900 through 2011, the AMO has gone through the following phases:

1900 through 1925	Cool	(Decreased Hurricane Activity)
1926 through 1969	Warm	(Increased Hurricane Activity)
1970 through 1994	Cool	(Decreased Hurricane Activity)
1995 through 2011	Warm	(Increased Hurricane Activity)

These AMO phases are illustrated by the plot of Sea Surface Temperature (SST) Anomalies (deviation from the mean) in the Atlantic Basin over the past 150 years in Figure 1-1.

The National Oceanic and Atmospheric Administration (NOAA) believes that we entered a warm phase of AMO around 1995 which can be expected to continue for at least several years; historically, each phase of AMO has lasted approximately 25 to 40 years.

Probabilistic Annual Damage & Loss is computed using the results of thousands of random variable hurricanes considering the long term 110 year hurricane hazard.

Factors considered in the analysis include the location of SCE&G's T&D assets, the probability of hurricanes of different intensities and/or landfall points impacting those assets, the vulnerability of those assets to hurricane damage, and the costs to repair assets and restore electrical service.

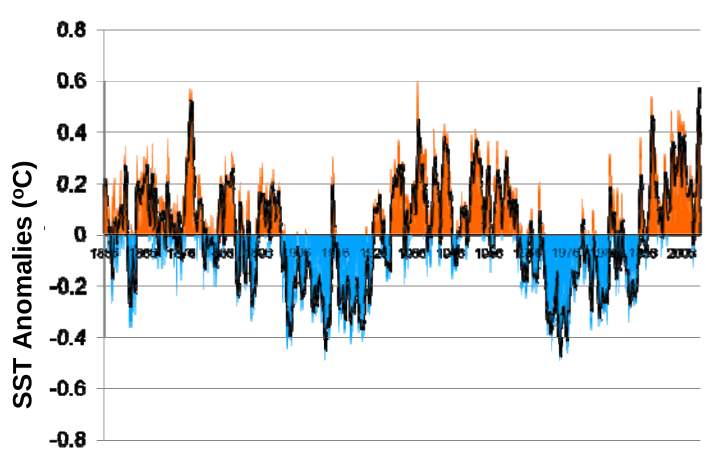

Figure 1-1: Atlantic Multidecadal Oscillation in Sea Surface Temperatures (SST) 1856-2010

Tropical Storm Exposure

In addition to storms strong enough to be classified as hurricanes, South Carolina is exposed to the threat of tropical storms (one-minute sustained wind speeds between 39 and 74 mph). The frequency of tropical storms in South Carolina is similar to that of hurricanes (note that the wind speed range associated with hurricanes is much wider, i.e. 74 mph to well over 155 mph).

EQECAT's tropical storm model was developed using methods very similar to those used to develop the hurricane model, generating a series of hypothetical storms representing the full range of tropical storms in terms of landfall location and track, severity, and frequency consistent with the observed historical data.

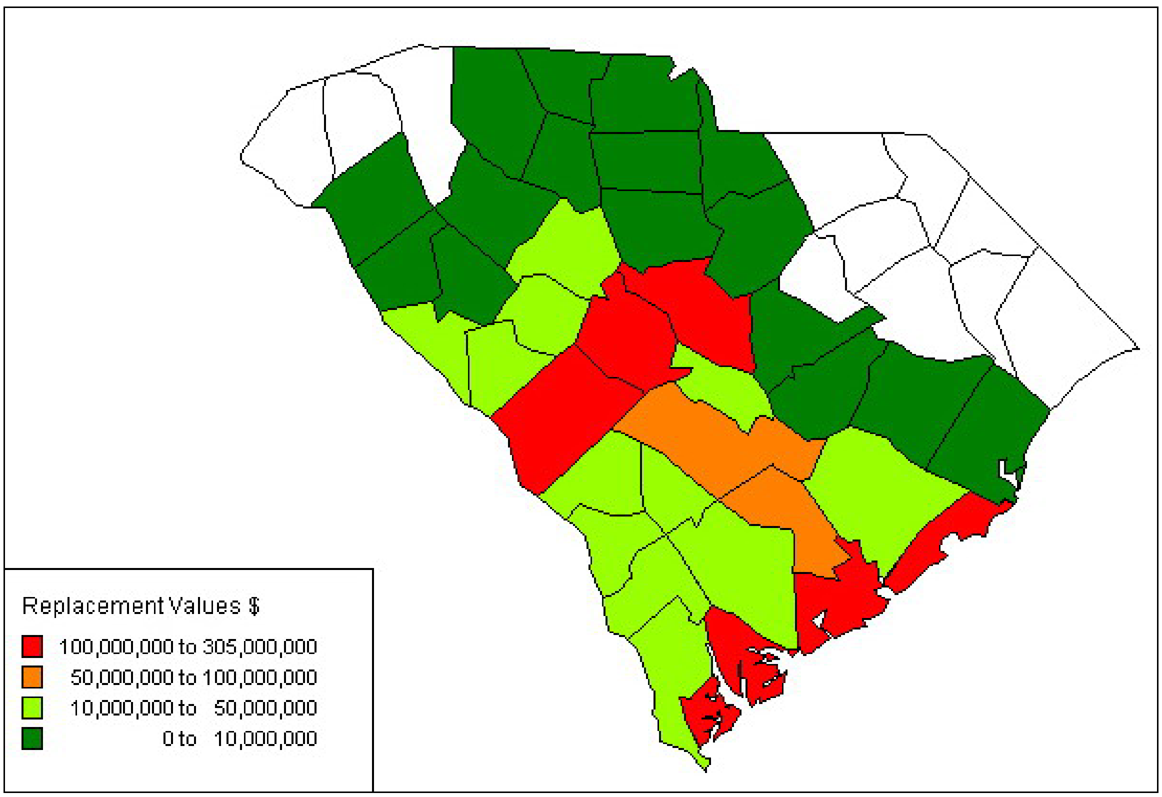

Figure 1-2: Transmission and Distribution Assets Values by County

Transmission and Distribution Asset Vulnerabilities

SCE&G's loss history from the Hurricane Floyd (2005), and Hurricane Hugo (1989) as well as other utility industry experience were considered in the calibration of the hurricane loss model. The hurricane loss experience includes the effects of many factors including the post hurricane costs of labor, mutual aid and other factors associated with the hurricane restoration process utilized by SCE&G.

Aggregate Damage Exceedance and Expected Annual Damage

A probabilistic database of losses is developed using the hurricane hazard, assets at risk and their vulnerabilities. For each hurricane, the center, shape, geographical orientation, track and wind speeds were defined. The wind field for each hurricane is integrated with the asset vulnerability and the asset locations to compute the damage. The annual frequency and the portfolio damage for each simulated hurricane is determined. By manipulating this database of thousands of hurricane losses, various loss exceedance or non-exceedance distributions are generated.

The frequencies and computed damage for all hurricanes are combined to calculate the expected annual loss and the annual aggregate exceedance relations.

Aggregate damage exceedance calculations are developed by keeping a running total of damage from ***all possible events*** in a year. At end of year, the aggregate damage for all events is then determined by probabilistically summing the damage distribution from each event, taking into account the event frequency. The process considers the probability of having zero events, one event, two events, etc. during the year.

A series of probabilistic analyses were performed, using the vulnerability curves derived for SCE&G T&D assets and the computer program USWIND™. A summary of the analyses are presented in Table 1-3, which shows the aggregate damage exceedance probability for damage levels between zero and $200 million dollars.

For each damage level shown, the probability of damage exceeding a specified value is shown. For example, the probability of damage exceeding $10 million in one year for the hurricane hazard is 16%. The analysis calculates the probability of damage from all hurricanes and aggregates the total.

Table 1-3. provides the aggregate damage exceedance probabilities for the SCE&G T&D assets for a series of damage levels at $10 million intervals.

The second column of the table, labeled 1 year Exceedance Probability, provides the 1-year modeled probability of exceeding the damage level, i.e. the probability that the total damage from all events in a 1 year period will exceed that level.

The expected annual damage (EAD) to T&D assets from the short term hurricanes hazard is $8.9 million. This value represents the average damage from all simulated hurricanes. The EAD is not expected to occur each and every year. Some years will have no damage from hurricanes, some years will have small amounts of damage and a few years will have large amounts of damage. The EAD represents the average of all hurricane losses over a long period of time.

A similar series of probabilistic analyses were performed for tropical storm hazards. A summary of the analyses are presented in Table 1-4, which shows the aggregate damage exceedance probability for damage levels between zero and $50 million dollars.

For each damage level shown, the probability of damage exceeding a specified value is shown. For example, the probability of damage exceeding $10 million in one year for the tropical storm hazard is 6.58%. The analysis calculates the probability of damage from all tropical storms and aggregates the total.

The expected annual damage (EAD) to T&D assets from the tropical storm hazard is $2.6 million.

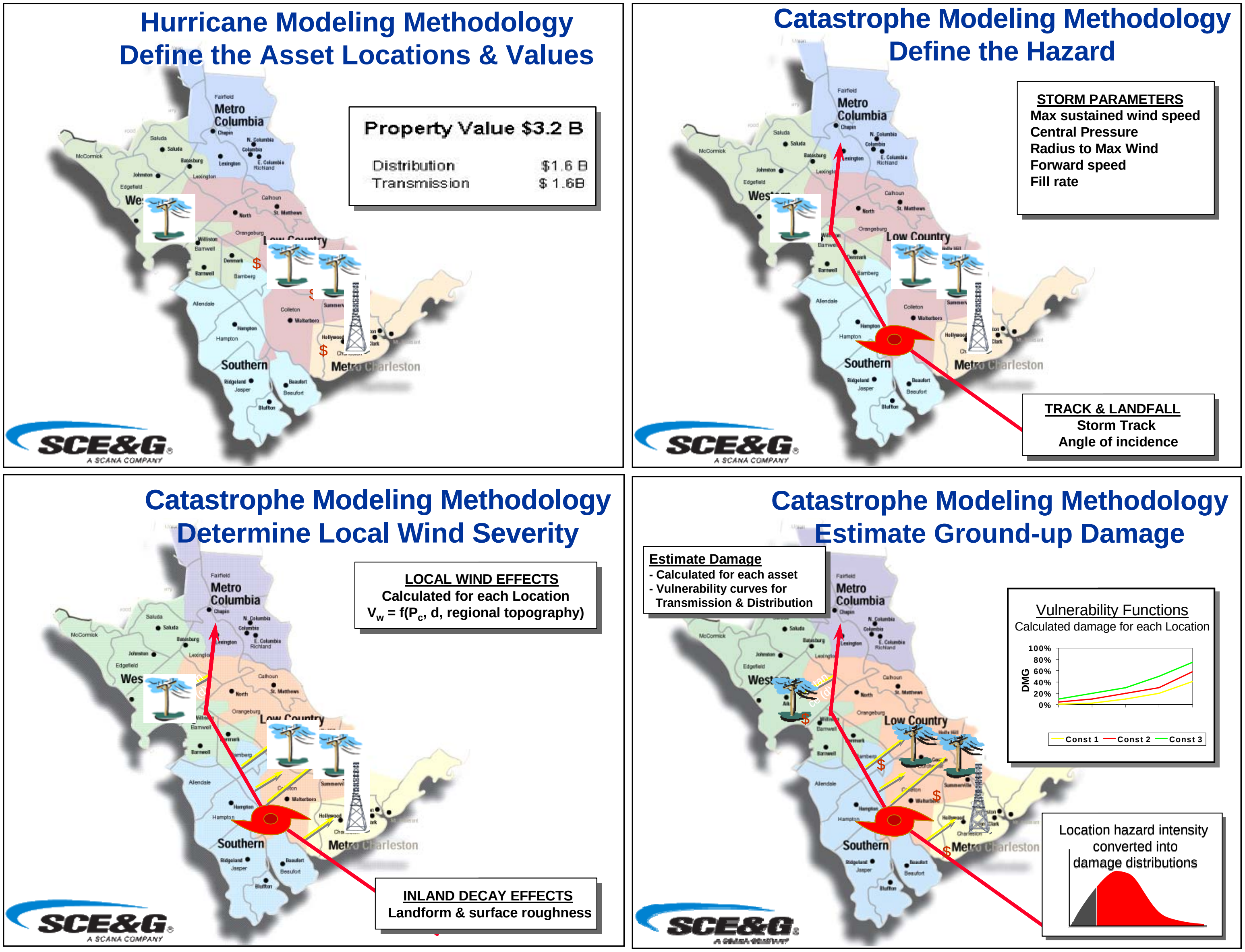

Figure 1-3: Portfolio Analysis Methodology

Table 1-3

SCE&G T&D ASSETS
AGGREGATE TOTAL DAMAGE EXCEEDANCE PROBABILITIES
SHORT TERM HURRICANE HAZARD

Damage Level	**1 Year**
($)	**Exceedance Probability**
≥2,500,000	21.5%
10,000,000	16.0%
20,000,000	11.7%
30,000,000	8.63%
40,000,000	6.50%
50,000,000	5.11%
60,000,000	4.12%
70,000,000	3.34%
80,000,000	2.75%
90,000,000	2.31%
100,000,000	1.96%
110,000,000	1.68%
120,000,000	1.46%
130,000,000	1.27%
140,000,000	1.11%
150,000,000	0.98%
160,000,000	0.87%
170,000,000	0.77%
180,000,000	0.69%
190,000,000	0.62%
200,000,000	0.56%

Table 1-4

SCE&G T&D ASSETS
AGGREGATE TOTAL DAMAGE EXCEEDANCE PROBABILITIES
TROPICAL STORM HAZARD

Damage Level	**1 Year**
($)	**Exceedance Probability**
≥ 2,500,000	14.1%
10,000,000	6.58%
20,000,000	3.89%
30,000,000	2.41%
40,000,000	1.55%
50,000,000	0.94%

2.0 Ice Storm Loss Analysis

Ice Storm Exposure

The ice storm exposure is analyzed from a probabilistic approach, which considers the full range of potential ice accretion characteristics and corresponding losses. Probabilistic analyses identify the probability of damage exceeding a specific dollar amount. USWinterStorm™ is a probabilistic model designed to estimate damage and losses due to the occurrence of ice and winter weather.

From the Mid-Atlantic coast to New England, the classic winter storm is called a Nor'easter— a strong coastal, extra-tropical storm, that develops off the eastern seaboard of the United States and then moves northeasterly along the coast. These storms cause strong northeasterly winds over coastal areas, and they may be accompanied by rain, heavy snow, and gale force to hurricane force winds. Wind-driven waves batter the coast from Georgia to Maine, causing flooding and severe beach erosion. Nor'easters typically form just north of Cuba or over the Florida peninsula. Those that form north of Cuba tend to track slowly north while intensifying over the open ocean. Storms that form over the Florida peninsula track northeast and intensify over the Gulf Stream. In both cases, these intense low pressure systems move northeast along the eastern seaboard and eventually into the open waters of the North Atlantic. The storm taps the Atlantic's moisture-supply and may dump heavy snows over a densely populated region. The snow and wind may combine into blizzard conditions and form deep drifts paralyzing the region. Ice Storms can also be caused by Nor'easters: Mountains, such as the Appalachians, act as a barrier to cold air trapping it in the valleys and adjacent low elevations. Warm air and moisture moves over the cold, trapped air. Rain falls from the warm layer onto a cold surface below becoming ice. Other winter storms result from cold air moving from the lee of the Rockies and penetrating south across Texas, the Gulf Coast and the Southeast (Figure 2-1).

The types of precipitation that can fall from a winter storm include snow, sleet, freezing rain and rain. The precipitation type that reaches the ground depends on the air mass structure through which the precipitation falls and the relative position of the low-pressure center and its associated warm and cold fronts. Most winter precipitation is the result of overrunning, a condition in which the air from a warm sector of the low-pressure system catches up to colder air ahead. Because the warm air is lighter, it is forced up and over the slow-moving, denser cold air near the ground (Figure 2-2).

Figure 2-1: Typical winter jet stream and US winter storm geographic pattern and the affected region.

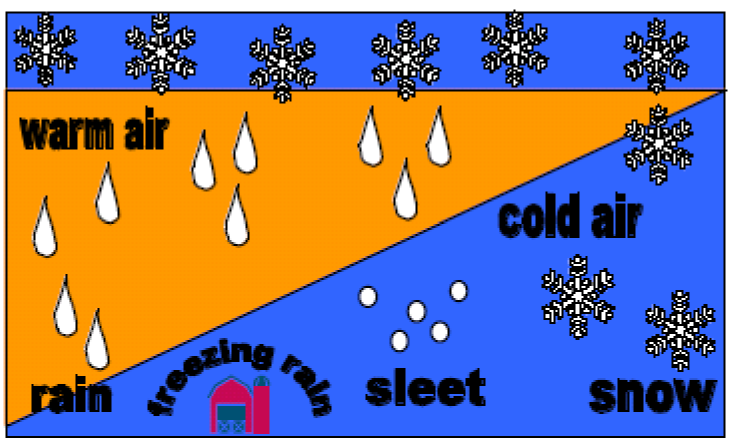

Figure 2-2: Various types of precipitation resulting from overrunning, when warm air rides over colder air near the ground.

Transmission and Distribution Asset Vulnerabilities

SCE&G's recent ice storm loss history includes ice storms in 2000, 2002 and 2004. These storms have been produced significant ice accumulation in parts of SCE&G's service territory that has resulted in damage to T&D assets. Damage from ice storms results from ice accumulation of structures, conductors and components causing direct damage. Damage also occurs from the ice accumulation and failure of trees and tree branches that impact poles and conductors. The ice storm loss experience includes the effects of many factors including the post storm costs of labor, mutual aid and other factors associated with the hurricane restoration process utilized by SCE&G that is discussed in more detail in Section 4.

Loss Estimation Methodology

The basic components of the hurricane risk analysis include:

- **Assets at risk:** define and locate
- **Ice storm hazard**: apply probabilistic winter weather model for the region
- **Asset vulnerabilities:** severity (ice accumulation) versus damage
- **Portfolio Damage:** probabilistic analysis -damage/ loss

Aggregate Damage Exceedance and Expected Annual Damage

A probabilistic database of losses is developed using the ice hazard, assets at risk and their vulnerabilities. For each ice storm, the temperature, barometric pressure, precipitation, elevation, wind speeds and duration were defined. The ice accumulation for each storm is integrated with the asset vulnerability and the asset locations to compute the damage. The annual frequency and the portfolio damage for each simulated ice storm is determined. By manipulating this database of thousands of ice storm losses, various loss exceedance or non-exceedance distributions are generated.

The frequencies and computed damage for all ice storms are combined to calculate the expected annual loss and the annual aggregate exceedance relations.

Aggregate damage exceedance calculations are developed by keeping a running total of damage from ***all possible events*** in a year. At the end of year, the aggregate damage for all events is then determined by probabilistically summing the damage distribution from each event, taking into account the event frequency. The process considers the probability of having zero events, one event, two events, etc. during the year.

A series of probabilistic analyses were performed, using the vulnerability curves derived for SCE&G T&D assets and the computer program USWinterStorm™. A summary of the analyses are presented in Table 2-1, which shows the aggregate damage (i.e. deductible is "0") exceedance probability for damage levels between zero and $130 million dollars.

For each damage level shown, the probability of damage exceeding a specified value is shown. For example, the probability of damage exceeding $10 million in one year for the ice storm hazard is 25.1%. The analysis calculates the probability of damage from all ice storms and aggregates the total.

Table 2-1. provides the aggregate damage exceedance probabilities for the SCE&G T&D assets for a series of damage levels at $10 million intervals.

The second column of the table, labeled 1 year Exceedance Probability, provides the 1-year modeled probability of exceeding the damage level, i.e. the probability that the total damage from all events in a 1 year period will exceed that level.

The expected annual damage (EAD) to T&D assets from the ice storm hazard is $10.1 million. This value represents the average damage from all simulated ice storms. The EAD is not expected to occur each and every year. Some years will have no damage from ice storms, some years will have small amounts of damage and a few years will have large amounts of damage. The EAD represents the average of all ice storm losses over a long period of time.

Table 2-1

SCE&G T&D ASSETS
AGGREGATE TOTAL DAMAGE EXCEEDANCE PROBABILITIES
ICE HAZARD

Damage Level	**1 Year**
($)	**Exceedance Probability**
≥ 2,500,000	40.0%
10,000,000	25.1%
20,000,000	15.6%
30,000,000	10.5%
40,000,000	7.35%
50,000,000	5.18%
60,000,000	3.68%
70,000,000	2.68%
80,000,000	1.97%
90,000,000	1.47%
100,000,000	1.09%
110,000,000	0.82%
120,000,000	0.63%
130,000,000	0.50%

3. Hurricane Landfall Analyses for SSI Ranges

In order to provide further insight into SCE&G's hurricane risk profile, the set of stochastic hurricane events were analyzed by landfall for hurricane intensities, SSI 2 through 4. The landfall locations are at mileposts from about 1900 to 2050 on the Atlantic Coast. Figure 3-1 below illustrates the landfall ranges. These mileposts on the Atlantic coast extend from the South Carolina – Georgia border near milepost 1900 to the South Carolina – North Carolina border near milepost 2050 at 10 mile intervals.

The set of simulated hurricanes results within the SSI category was analyzed for SCE&G's T&D portfolio. For each milepost and SSI category, the frequency-weighted average damage was computed from all stochastic hurricanes making landfall within 10 nautical miles of a given milepost and within that SSI category. Figures 3-2 through 3-4 provide these results.

The current reserve amount is also shown superimposed on Figures 3-2 through 3-4 as a red dashed line and shows that the current reserve has adequate reserve for some, but not all, Category 2 single hurricane damage values.

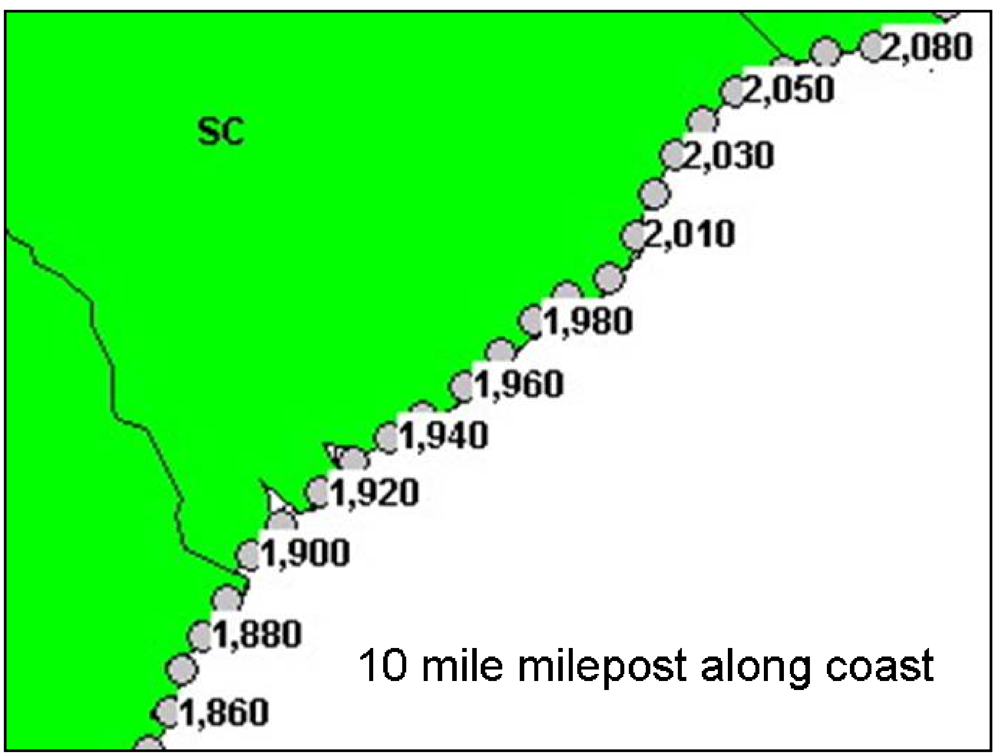

Figure 3-1: Hurricane Landfall Milepost

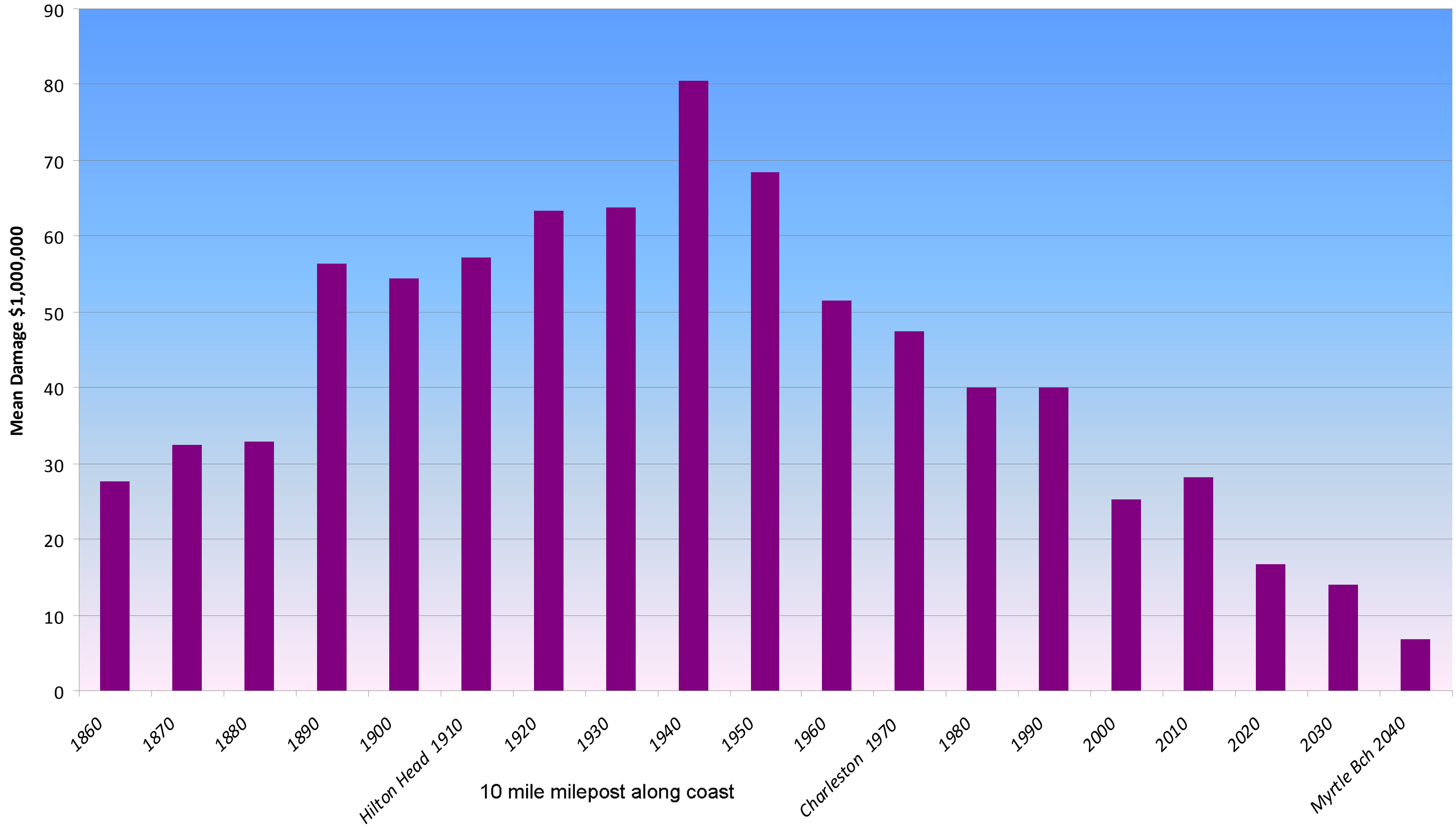

Figure 3-2: Frequency Weighted Average Transmission & Distribution Damage from Single SSI 2 Landfalls

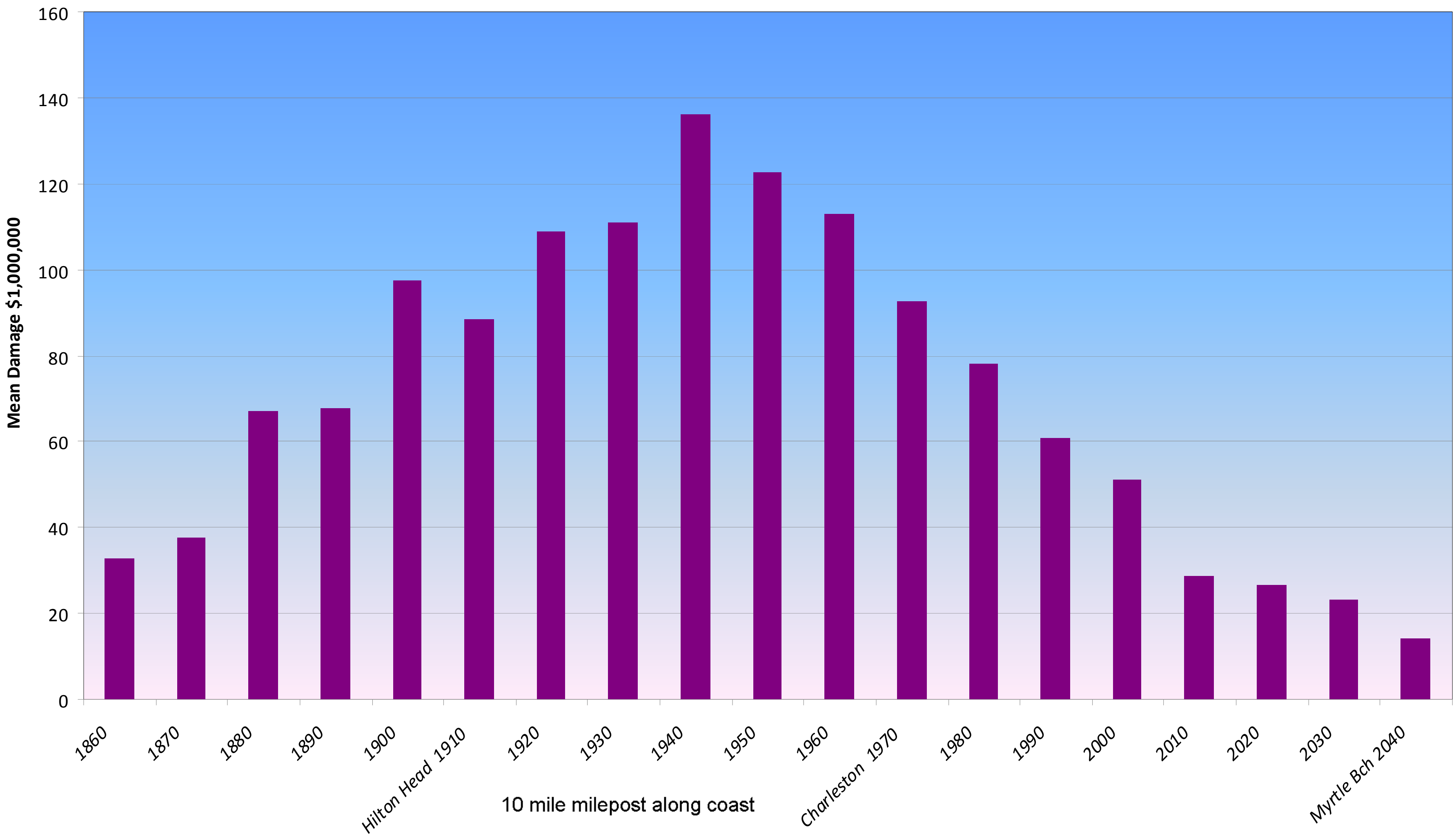

Figure 3-3: Frequency Weighted Average Transmission & Distribution Damage from Single SSI 3 Landfalls

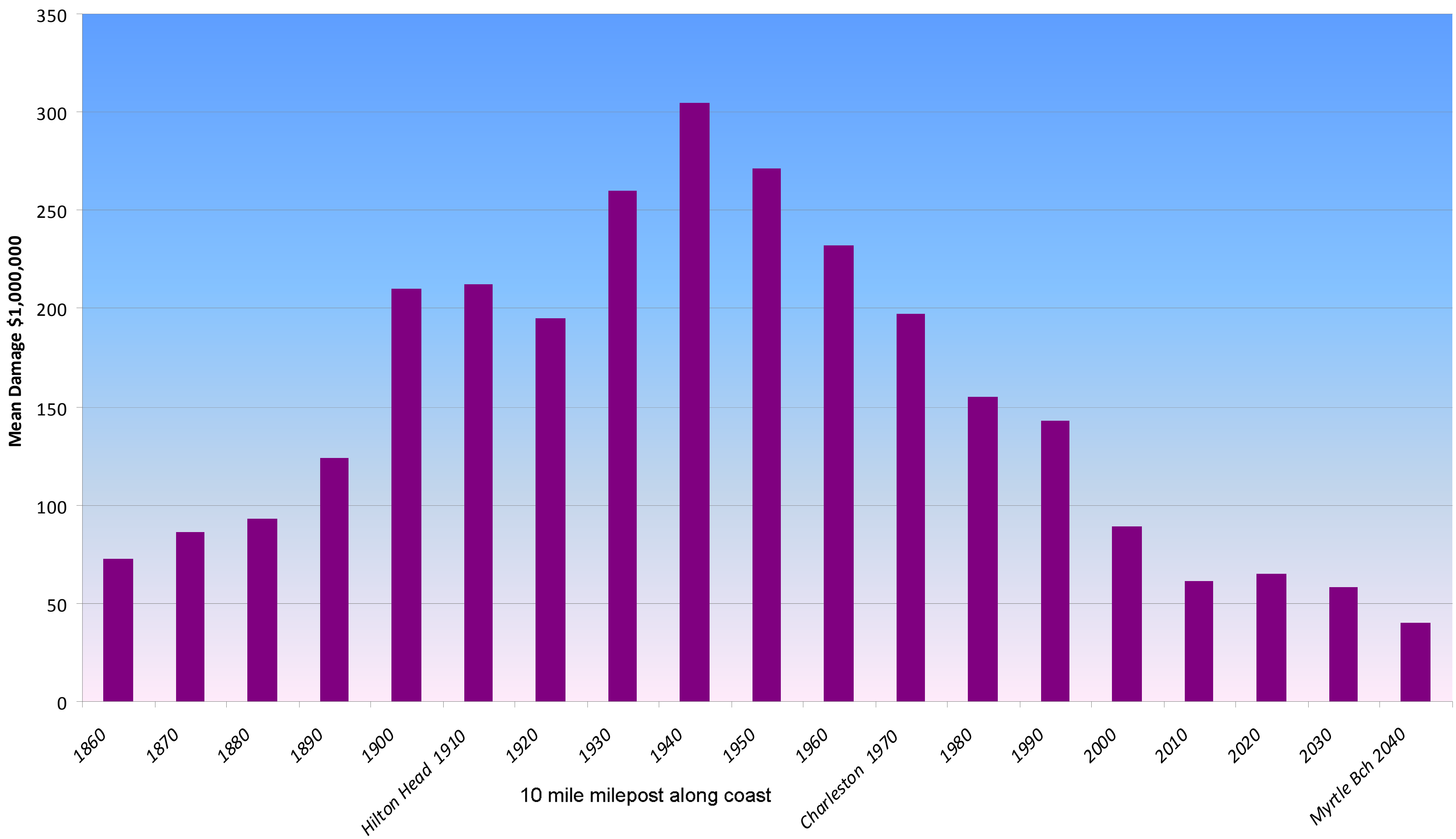

Figure 3-4: Frequency Weighted Average Transmission & Distribution Damage from Single SSI 4 Landfalls

4.0 Reserve Performance Analysis

Two trial probabilistic analysis of collection strategies for the SCE&G storm reserve and damage from hurricanes, tropical storms, and ice storms were performed to determine their effects on the performance of the Reserve.

Analysis

The trial reserve performance analyses consisted of performing 10,000 iterations of hurricane, tropical storm, and ice storm damage simulations within the SCE&G service territory, each covering a 5-year prospective period, to determine the effect of the charges for damage and collection strategies on the SCE&G reserve. Monte Carlo simulations were used to generate damage samples for the analysis. The analysis provides an estimate of the reserve assets in each year of the simulation, accounting for the initial amounts, the annual collections, and hurricane, tropical, and ice storm damage using a dynamic financial model.

Assumptions

Analyses were performed which included the following assumptions:

- All analyses include an initial reserve amount of $30.1 million.
- Annual reserve collections are either $0, or $6.1 million per year.
- Two cases were analyzed:
    - No collection, $70 million insurance in excess of losses of $100 million, and recovery of negative amounts over 5 years.
    - $6.1 million collection, $70 million insurance in excess of losses of $100 million, and recovery of negative amounts over 5 years.
- The expected annual hurricane, tropical storm, and ice storm damage is $21.6 million as described in Sections 1 and 2. A $7.8 million portion of the expected annual damage of $21.6 million, 46.8% of the full EAD in excess of a $2.5 million SCG&E retention, is assumed to be an obligation to the Reserve.
- SCE&G T&D asset values, along with hurricane, tropical storm, and ice storm losses are assumed to grow at a 5% annual rate over the simulation period.

The results show the initial amount, the mean (expected) reserve amount over the five year simulation period. The probability that the reserve will be negative in any one or more of the five years of the simulated time horizon for each case is also determined. Figures 4-1 and 4-2 show the results of the reserve performance analyses. These results show the mean (or expected values) of the reserve as well as the 5^{th} and 95^{th} percentiles.

Figure 4-1, shows the results of the current reserve conditions, with no annual collection, and $70 million of insurance in excess of $100 million damage, and recovery of negative amounts over 5 years. Given an initial reserve amount of $30.1 million, the reserve has a mean (expected) amount of negative ($7.2 million) at the end of the five year period. The 5^{th} percentile and 95^{th} percentile year 5 ending reserve amounts are a negative ($65.9 million) and about $27.6 million. The reserve has a 52% chance of being inadequate in one or more of the five years of the simulation and a 0% chance of having an amount of $50 million or greater within the five years of the simulation.

Similarly, Figure 4-2 shows a similar analysis result assuming that the reserve has a reinstated $6.1 million annual collection. For an initial reserve of $30.1 million, $6.1 million annual collection, $70 million of insurance in excess of $100 million damage, and recovery of negative amounts over 5 years. The mean (expected) amount of the reserve is a positive $20.6 million at the end of the five year period for the combined hurricane, tropical storm, and ice perils. The 5^{th} percentile and 95^{th} percentile year 5 ending reserve amounts are $58 million and negative ($42.8 million). There is a 29% chance that the reserve will be inadequate in one or more of the five years of the simulation and about a 23% chance of having an amount of $50 million or greater within the five years of the simulation.

Both five year ending reserve amounts are less than the current $30.1 million. Both analyses show a decline in the reserve amount at the end of five years. The amount in the case with a $6.1 million collection reinstated will remain positive at about two thirds of its current value. A comparison of the 5th percentile amounts in the two cases, 1) with no collection, a negative ($65.9 million), and 2) with an collection, a negative ($42.8 million), shows a reduction of $23.1 million in potential catastrophic exposure.

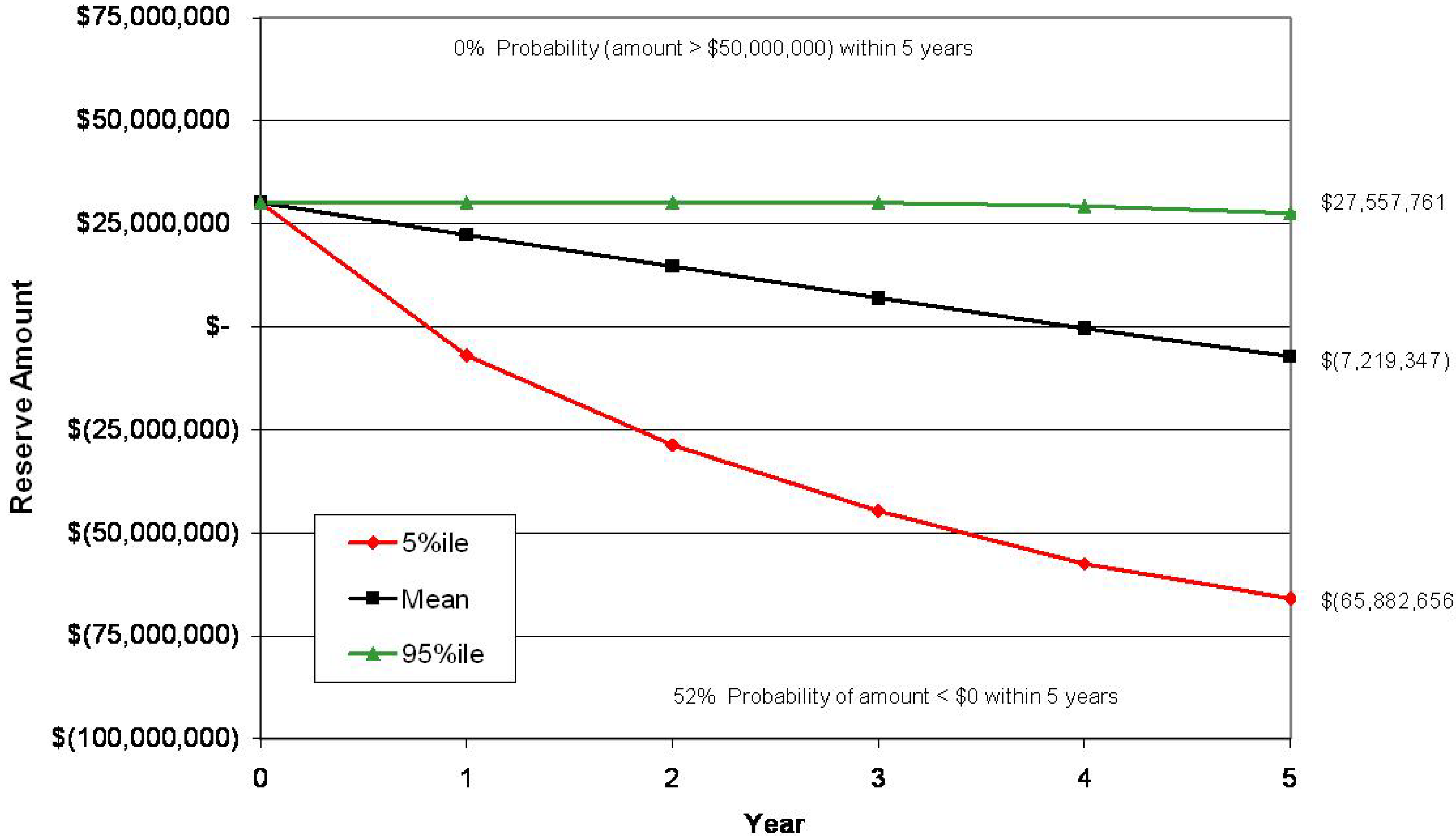

Figure 4.1: Reserve Performance Analysis: No Annual Collection, $70 million insurance, 5 year recovery

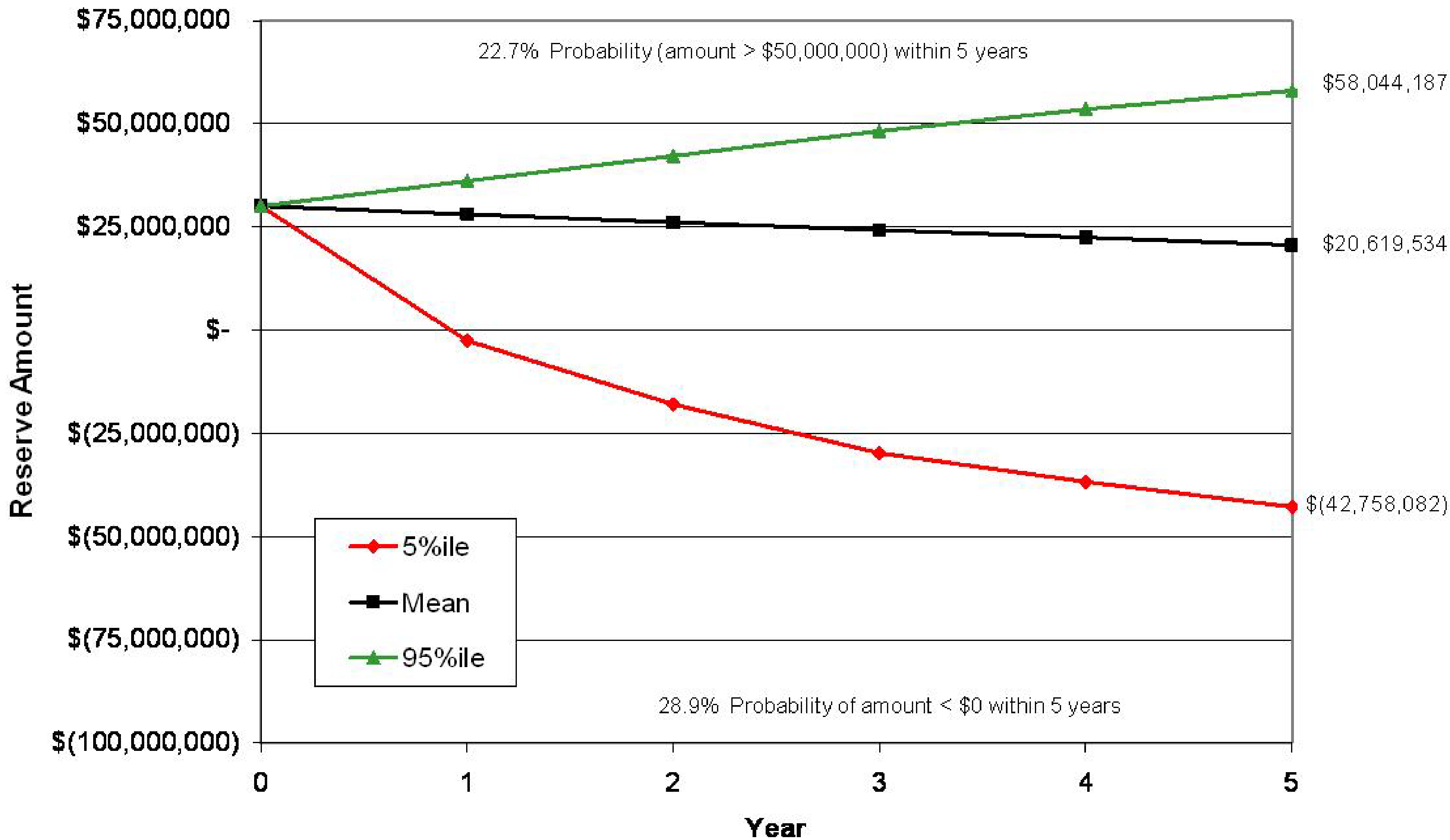

Figure 4.2: Reserve Performance Analysis: $6.05 million Annual Collection, $70 million insurance, 5 year recovery

5.0 Limitations

SCE&G has had favorable hurricane and ice storm experience over the past three decades. SCE&G's significant hurricane losses consist of Hurricane Floyd in 1999 and Hurricane Hugo in 1989. There have been no significant hurricane losses less than 8 years old. SCE&G has had three ice storm events in the 2000, 2002 and 2004. All these losses have been relatively small. In the development and calibration of the hurricane loss model for SCE&G, EQECAT has explicitly considered SCE&G's two past hurricane losses along with loss experience from other electric utilities in the southeast United States.

There are many factors that can affect hurricane and ice storm damage and service restoration cost that may be significantly different from today than from the conditions at the time of Hurricanes Floyd and Hugo. These factors include the age and material conditions of SCE&G infrastructure. There have also been changes in land use since the historic events that can change onshore wind speeds, and there are differences in vegetation and urbanized structures, both of which generate damaging debris. Utility restoration practices, schedules, mutual aid agreements, and availability of contract services and materials also will affect service restoration costs. The general level of damage to regional water, transportation, structures and telecommunications and other infrastructure also affects the total difficulty and cost of service restoration.

Much of the damage experienced in Hurricane Hugo in coastal regions around Charleston required replacement of damaged infrastructure. New SCE&G infrastructure may be designed to more recent and higher design standards. Therefore the current vulnerability of SCE&G assets should be expected to be different from those in place during past hurricanes.

Hurricane and ice storm events also exhibit significant variability in wind and ice fields. Hurricanes also have the potential for some events to generate devastating tornado micro-bursts. High moisture content of soils are also associated with higher amounts of damage to distribution assets due to fallen trees and lower strength of poles. Transmission and distribution system damage and system restoration costs in future events should therefore be expected to subject to these types of variability. The modeled loss estimates for specific future events will not and should not be expected to precisely reflect actual system restoration costs due to the unknown nature of future events and the variability associated with the damage and the restoration processes.

6. References

1. “Florida Commission on Hurricane Loss Projection Methodology”, EQECAT, an ABS Group Company, May 17, 2011.

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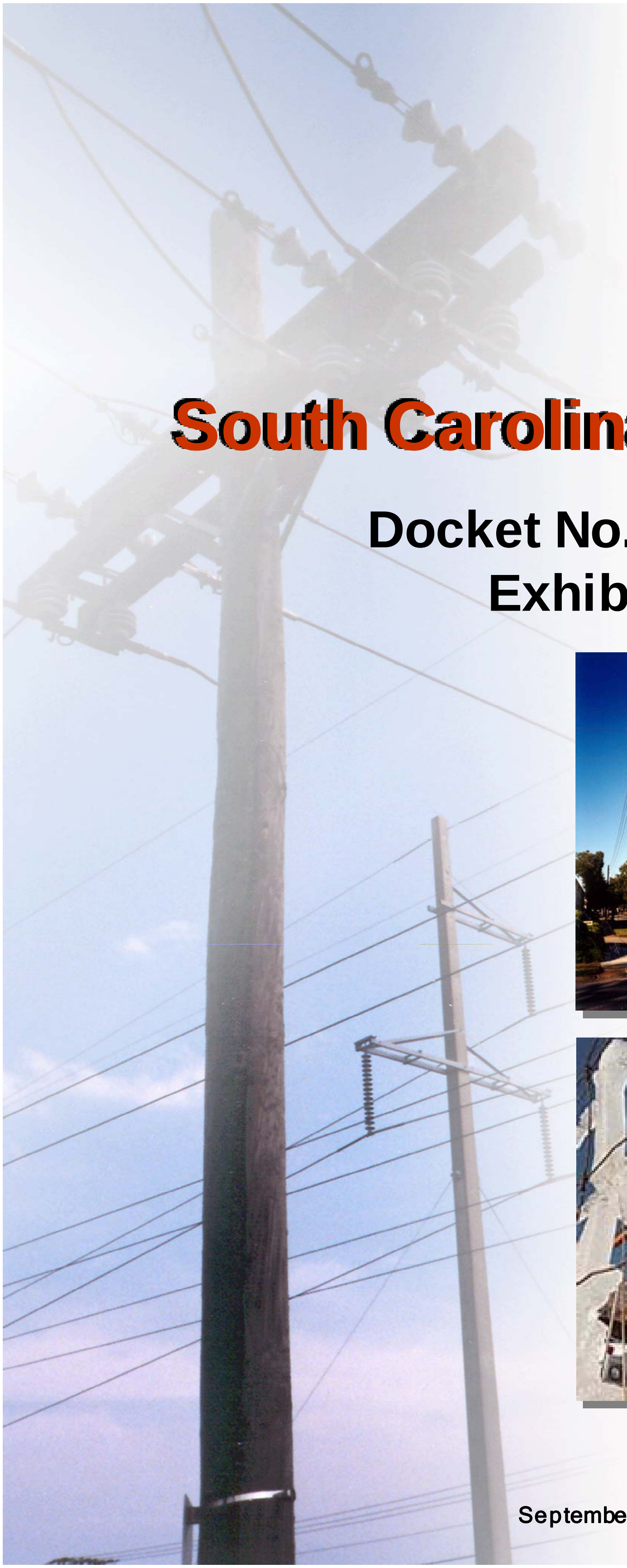
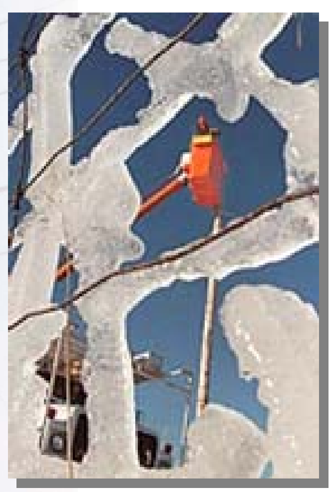
Exhibit No.:____________
Exhibit SPH2



An ABS Group Company

South Carolina Electric & Gas

Docket No. 2012-218-E
Exhibit SPH2



September 2012

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1. Historical Storms- NOAA

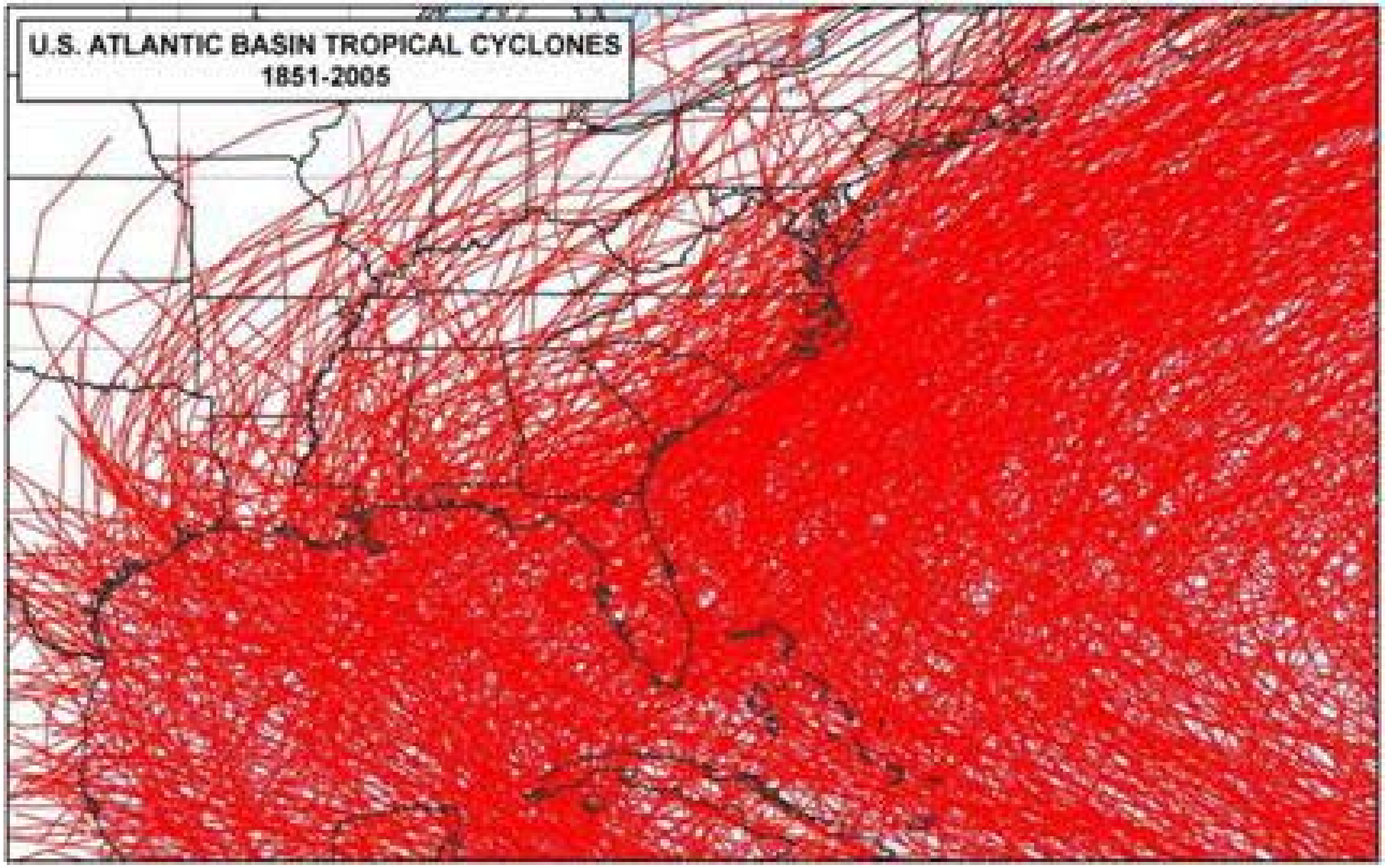


Figure 1-1a: NOAA: Hurricane Strikes 1851-2005

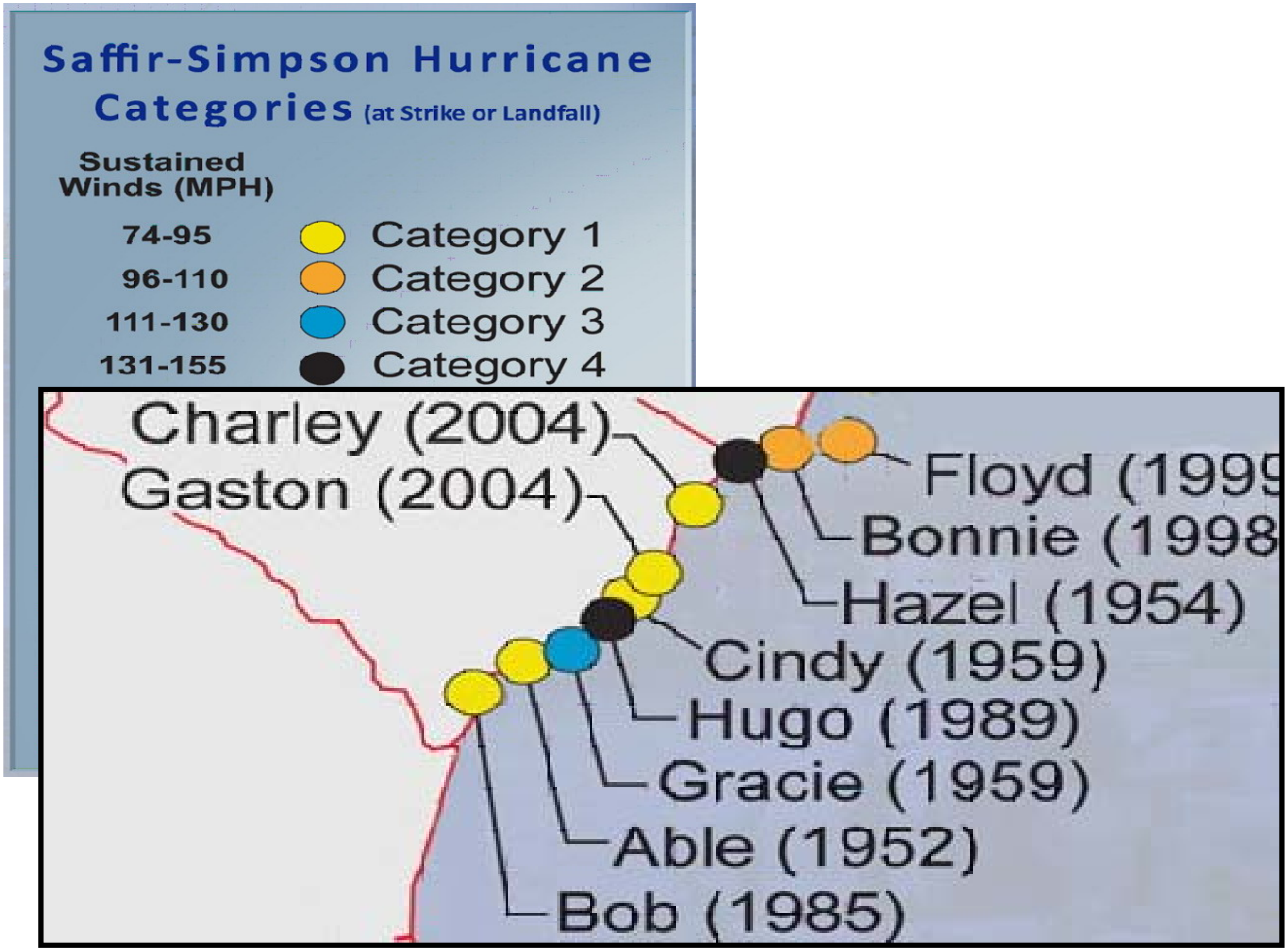


Figure 1-1b: NOAA: Hurricane Strikes South Carolina 1950-2011

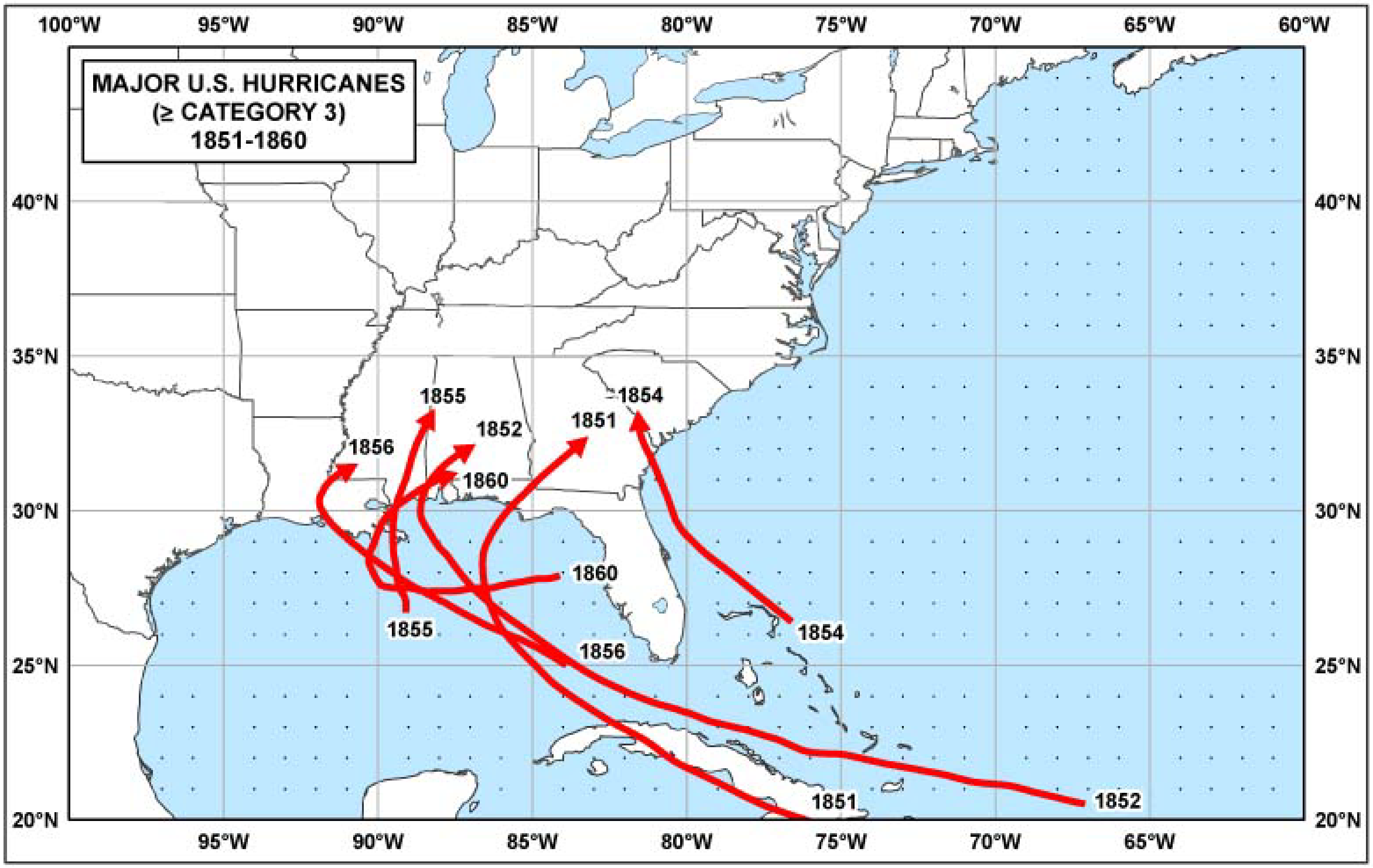
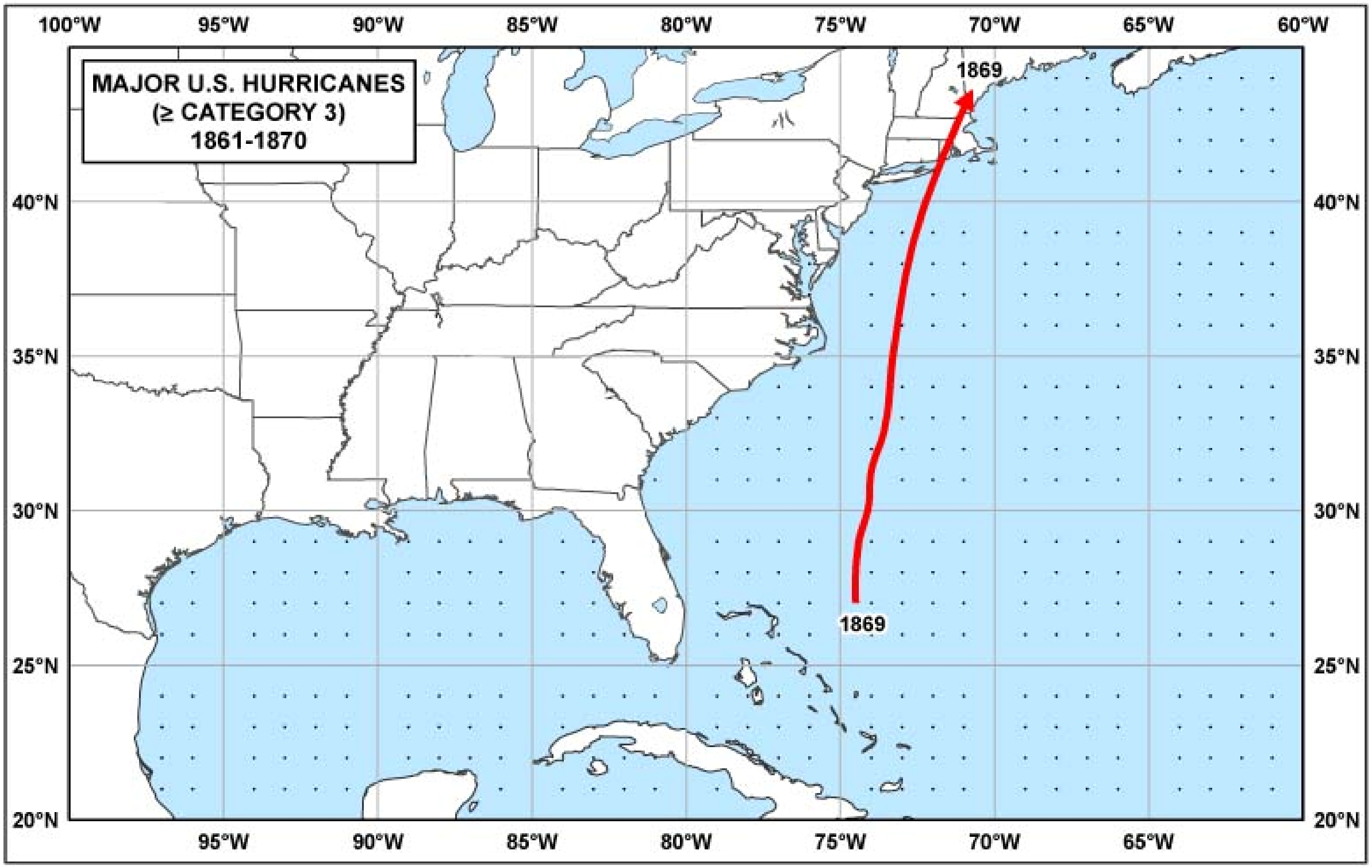


Figure 1. Landfalling United States major hurricanes (stronger than or equal to a category 3) during the period 1851-1860.



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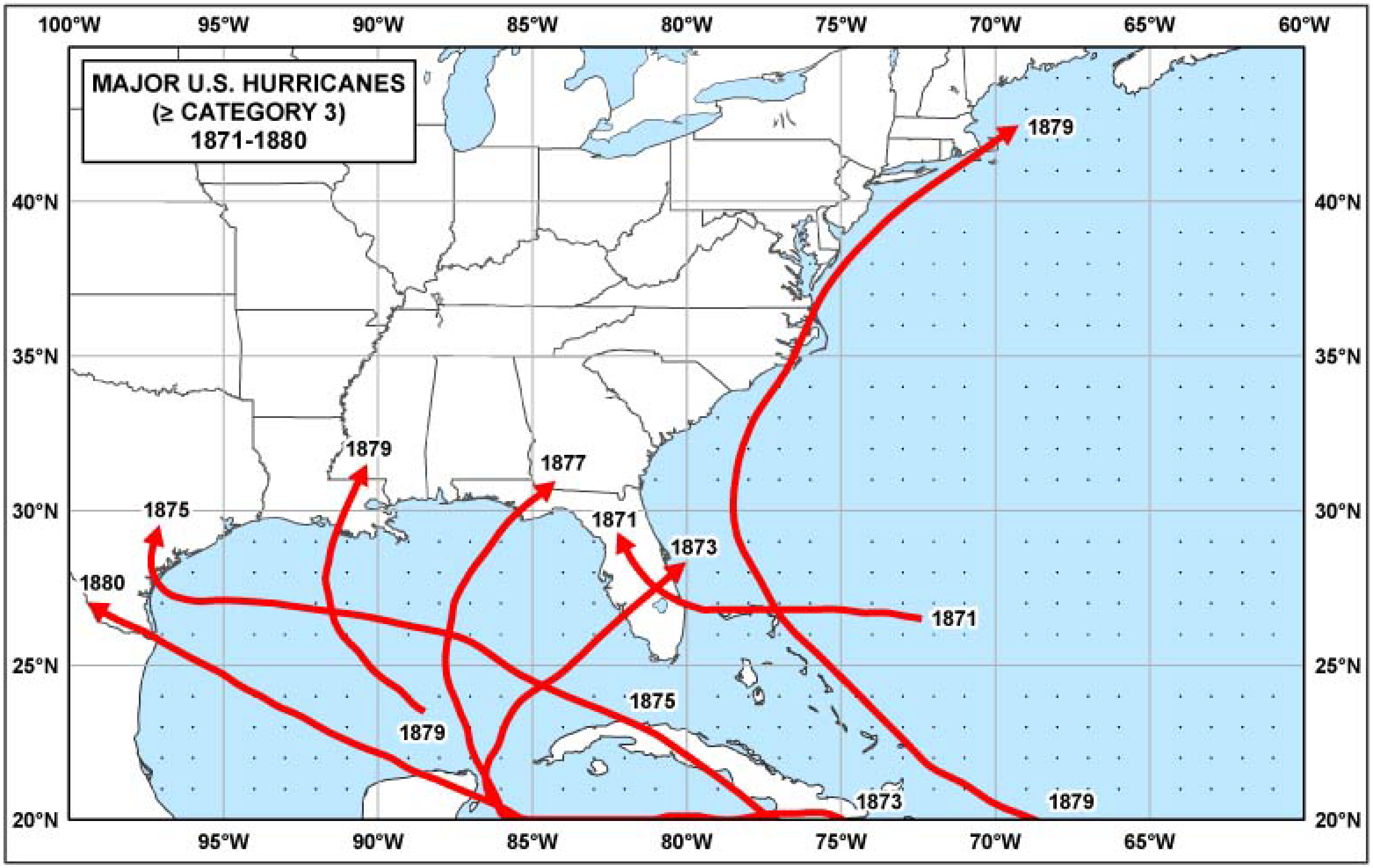

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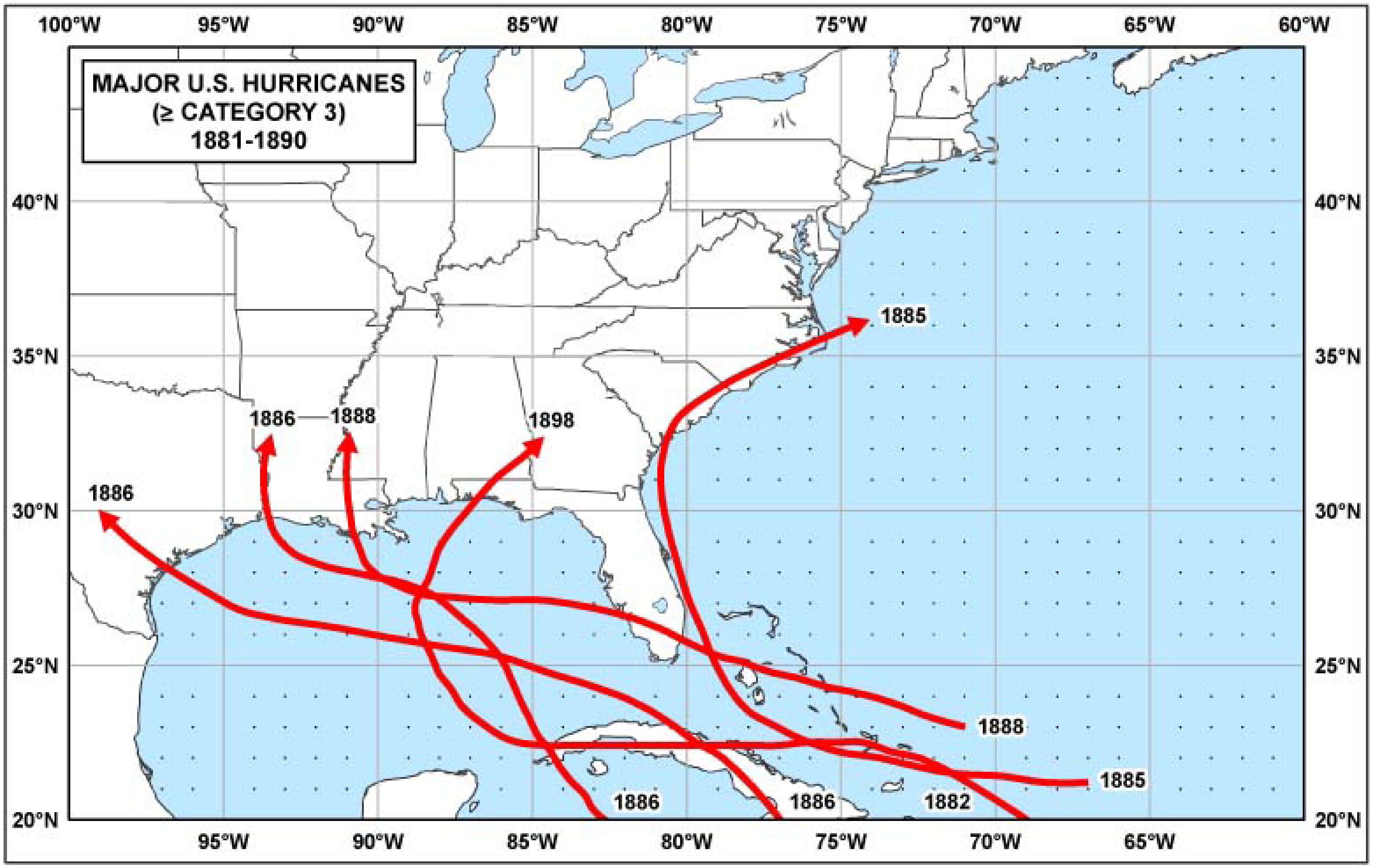

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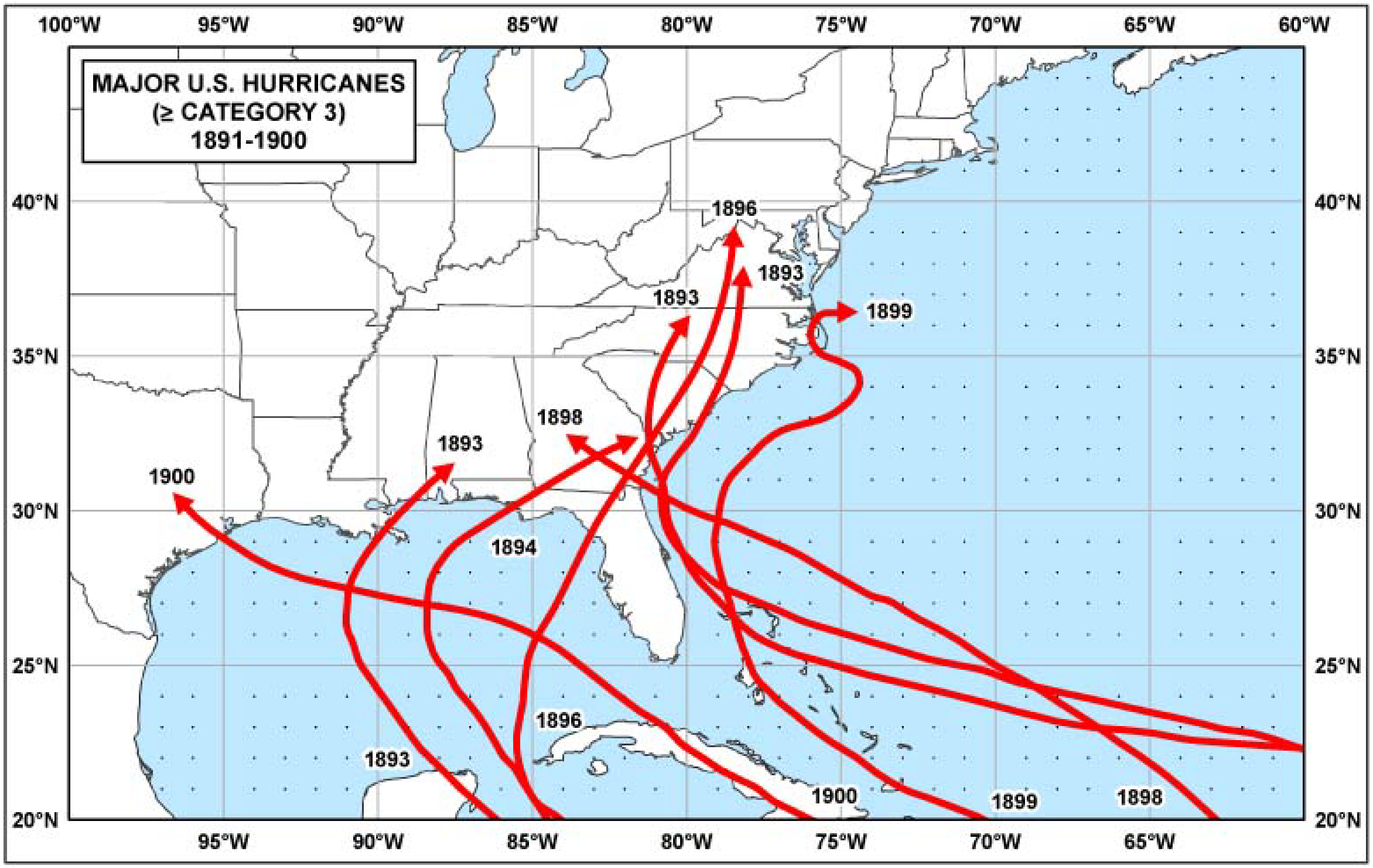

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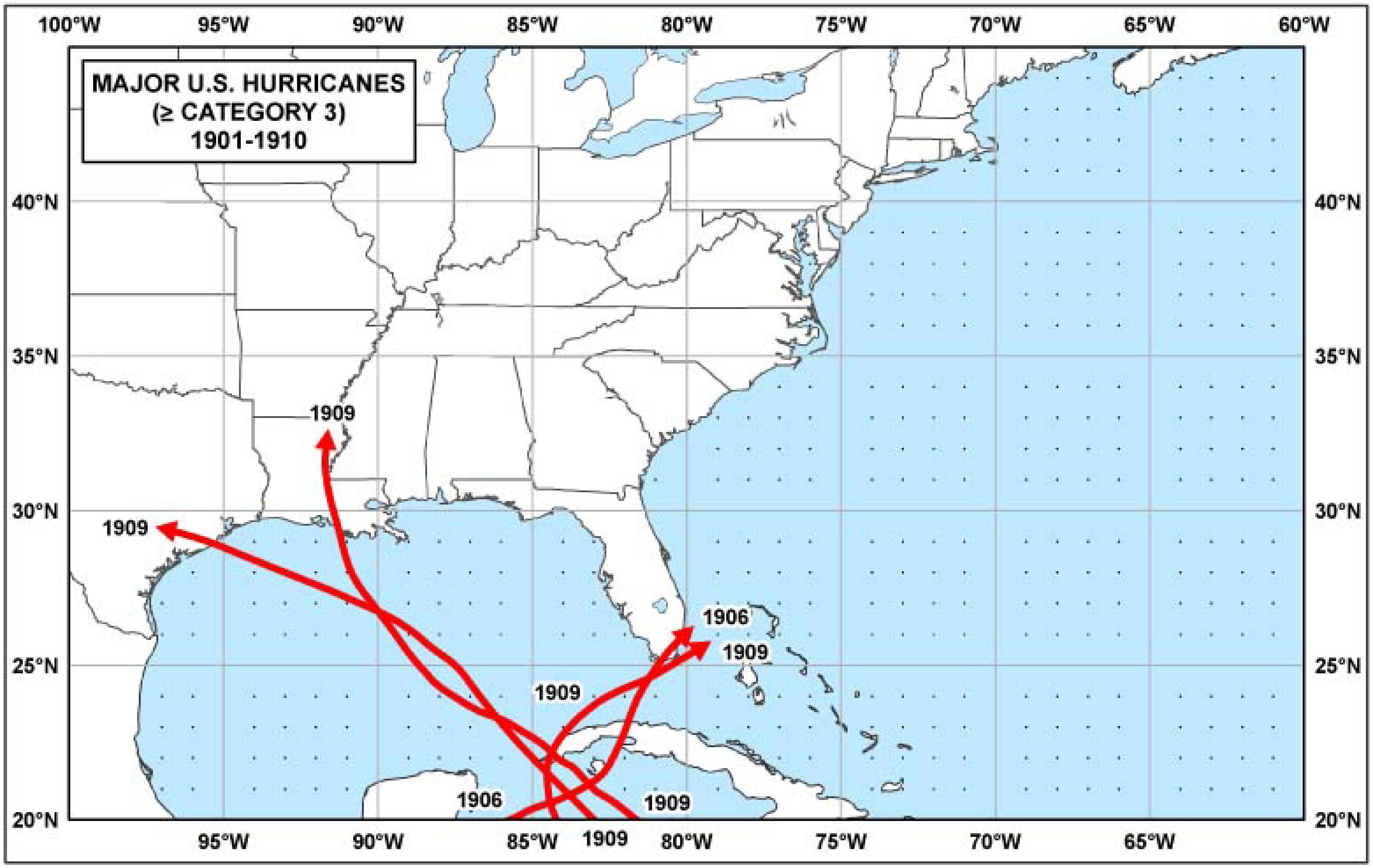

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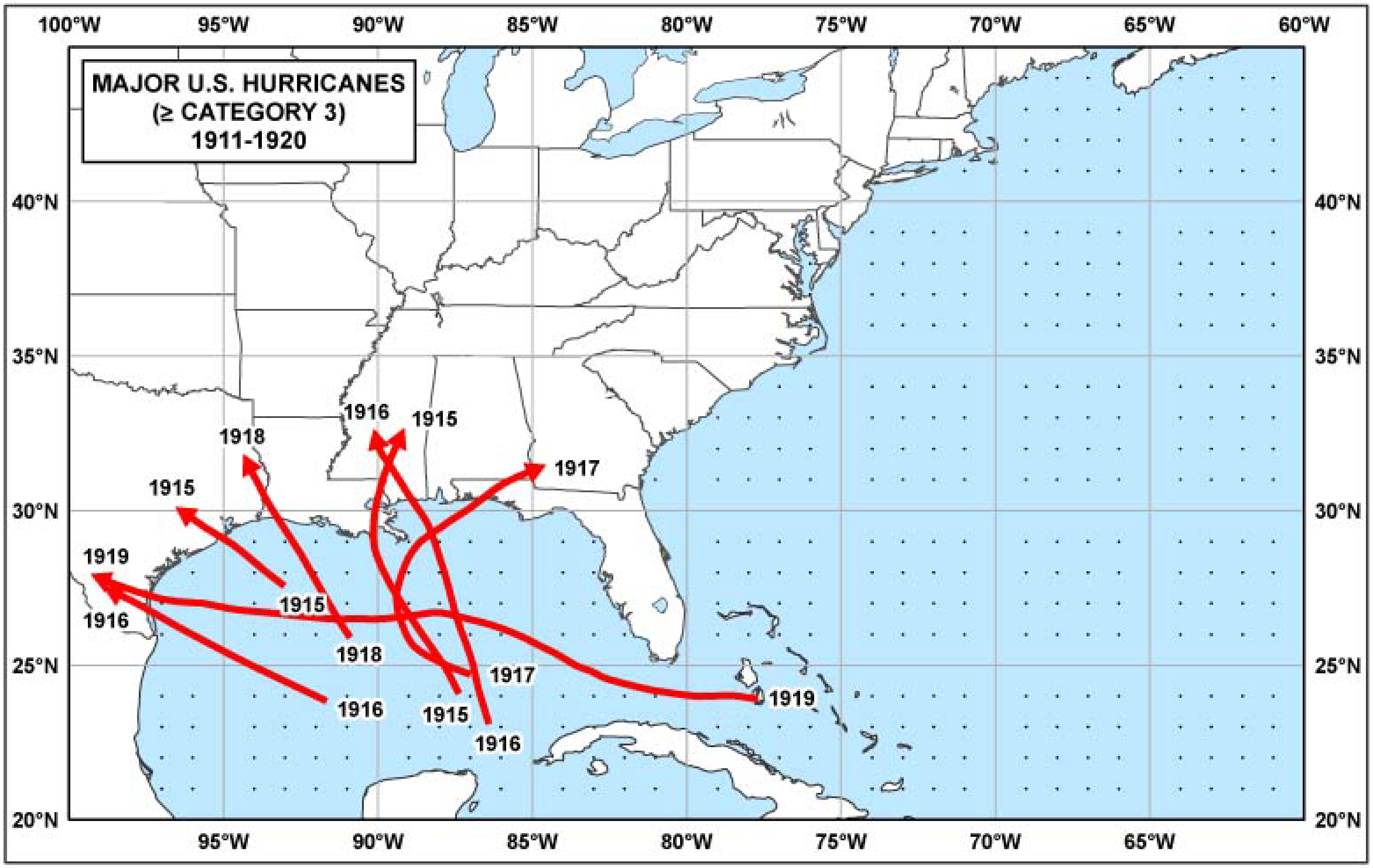

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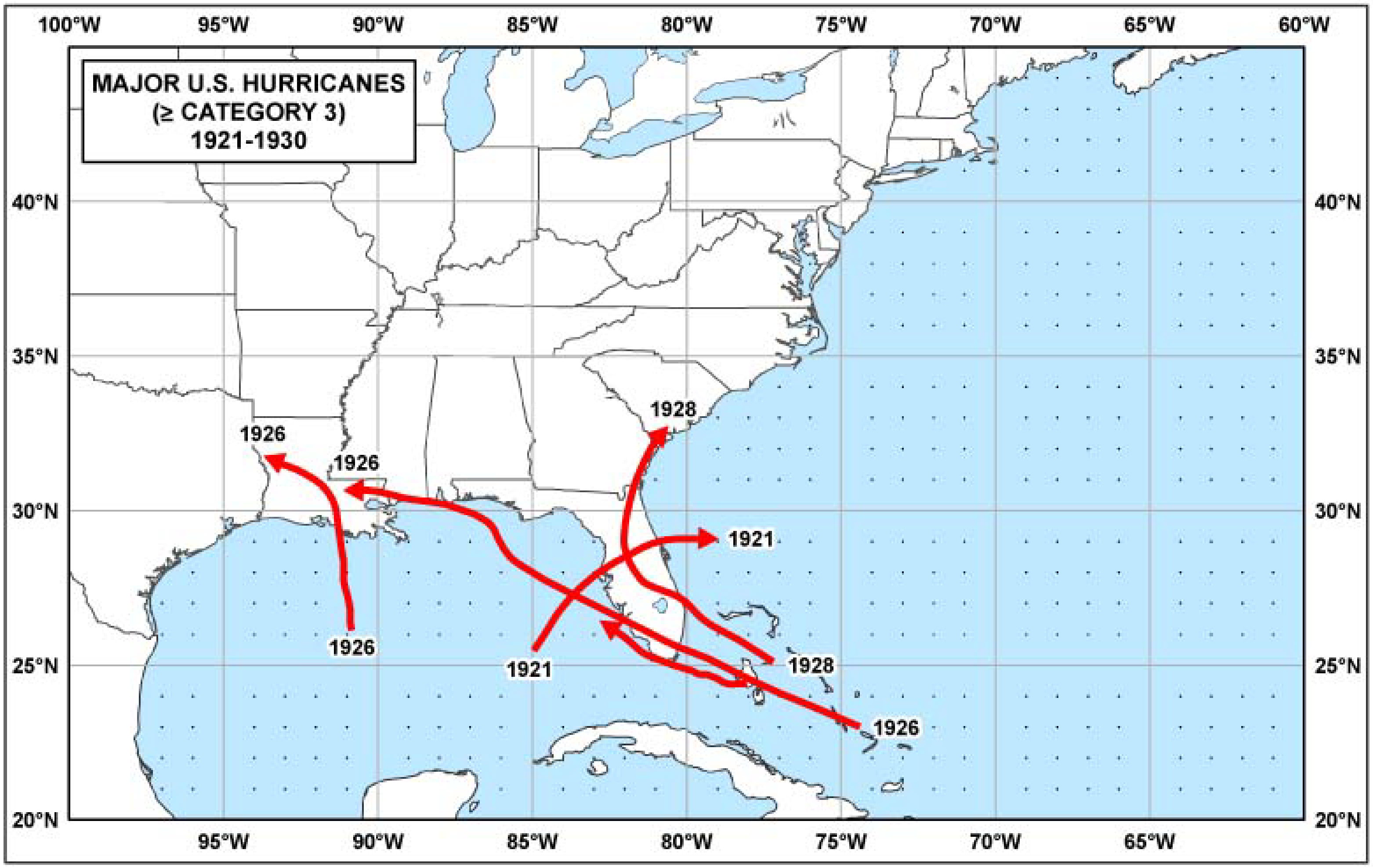

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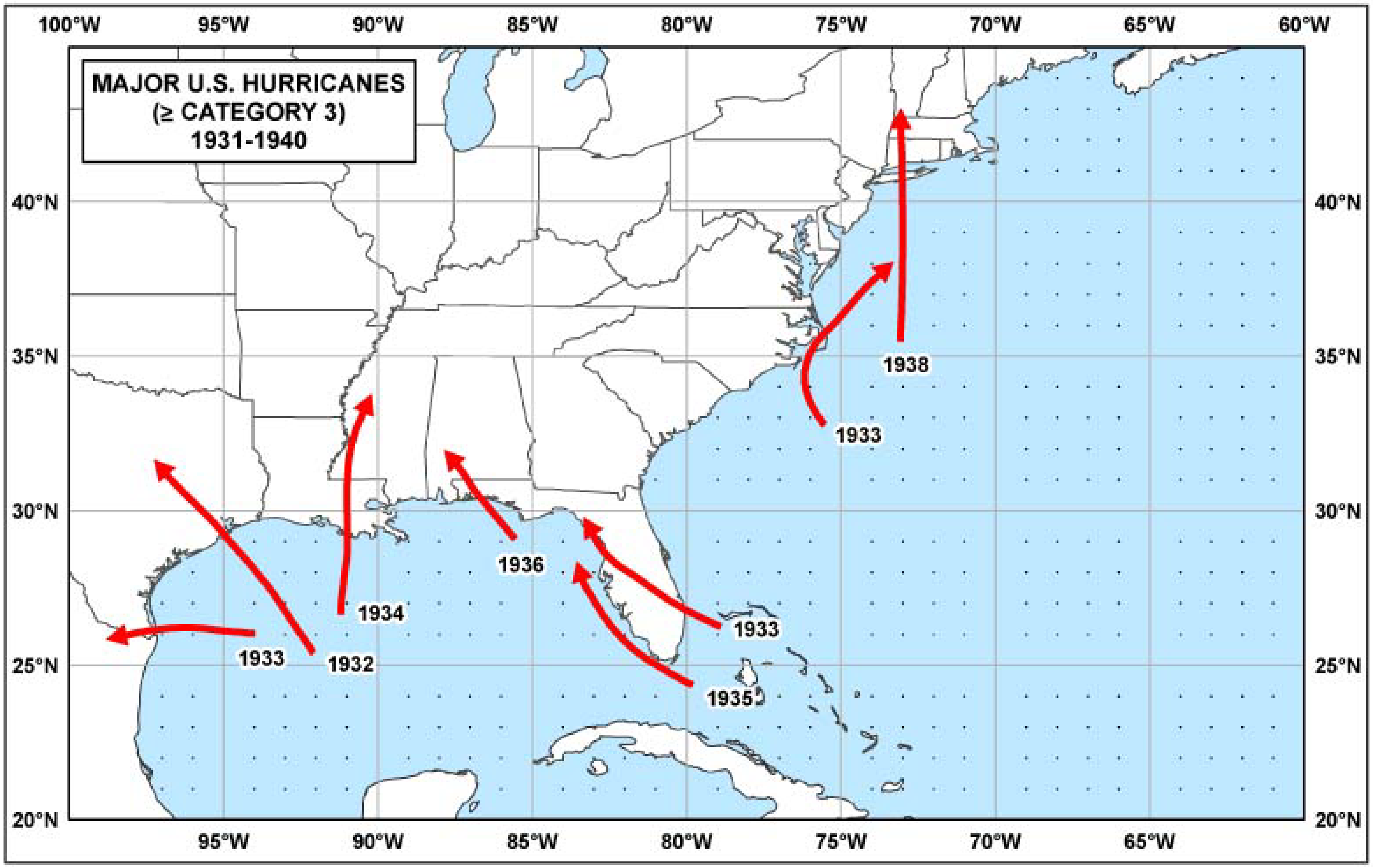

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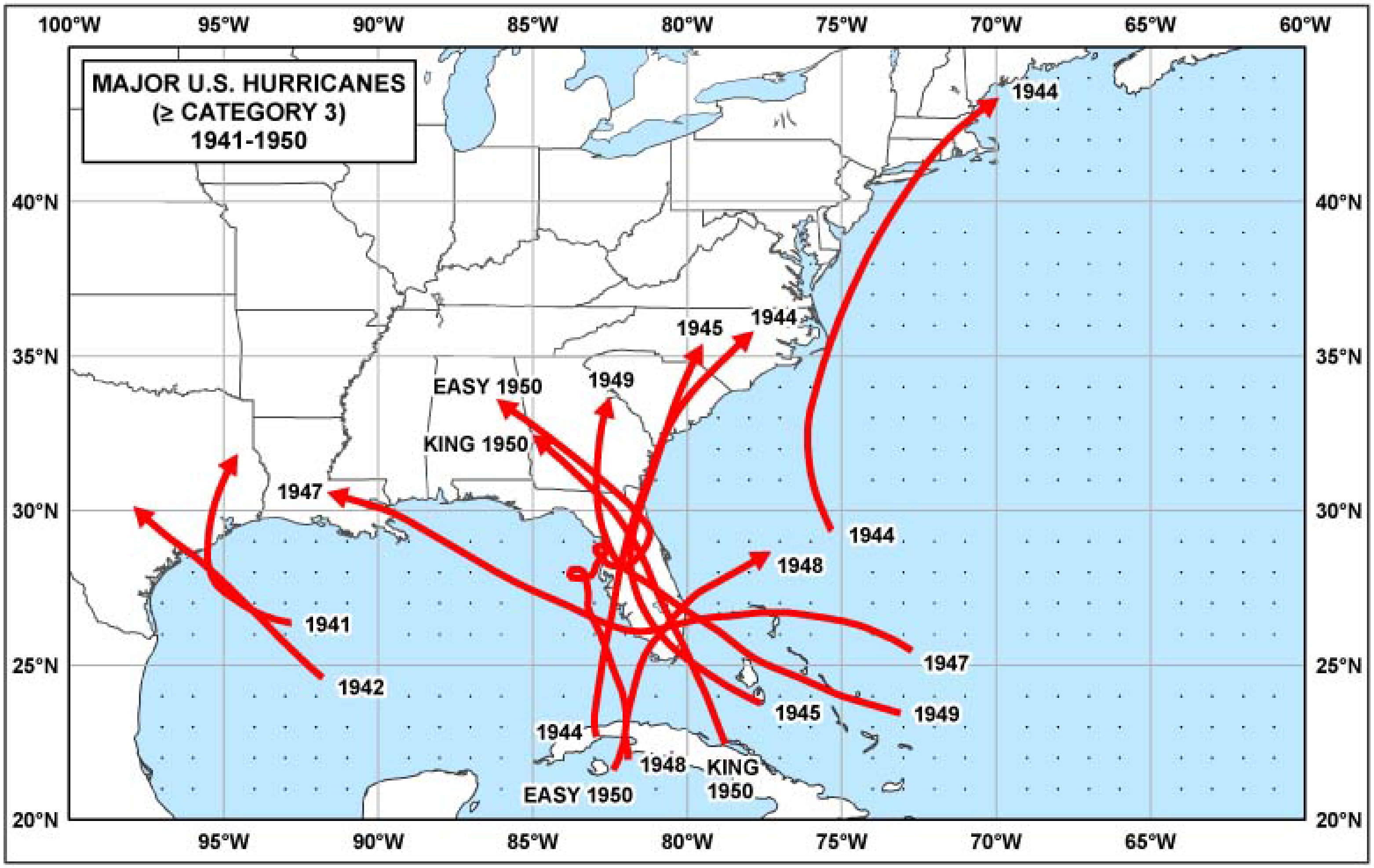

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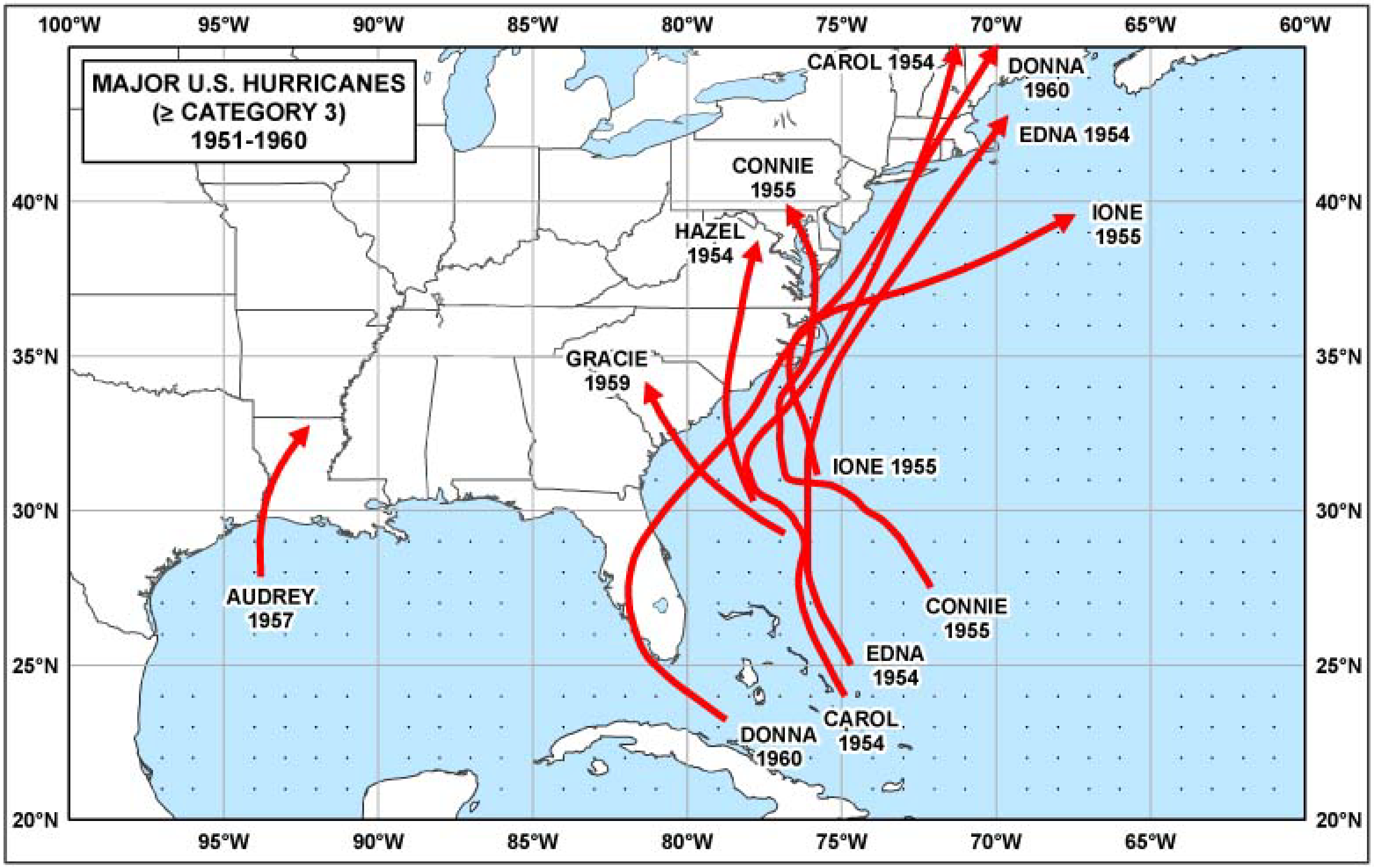

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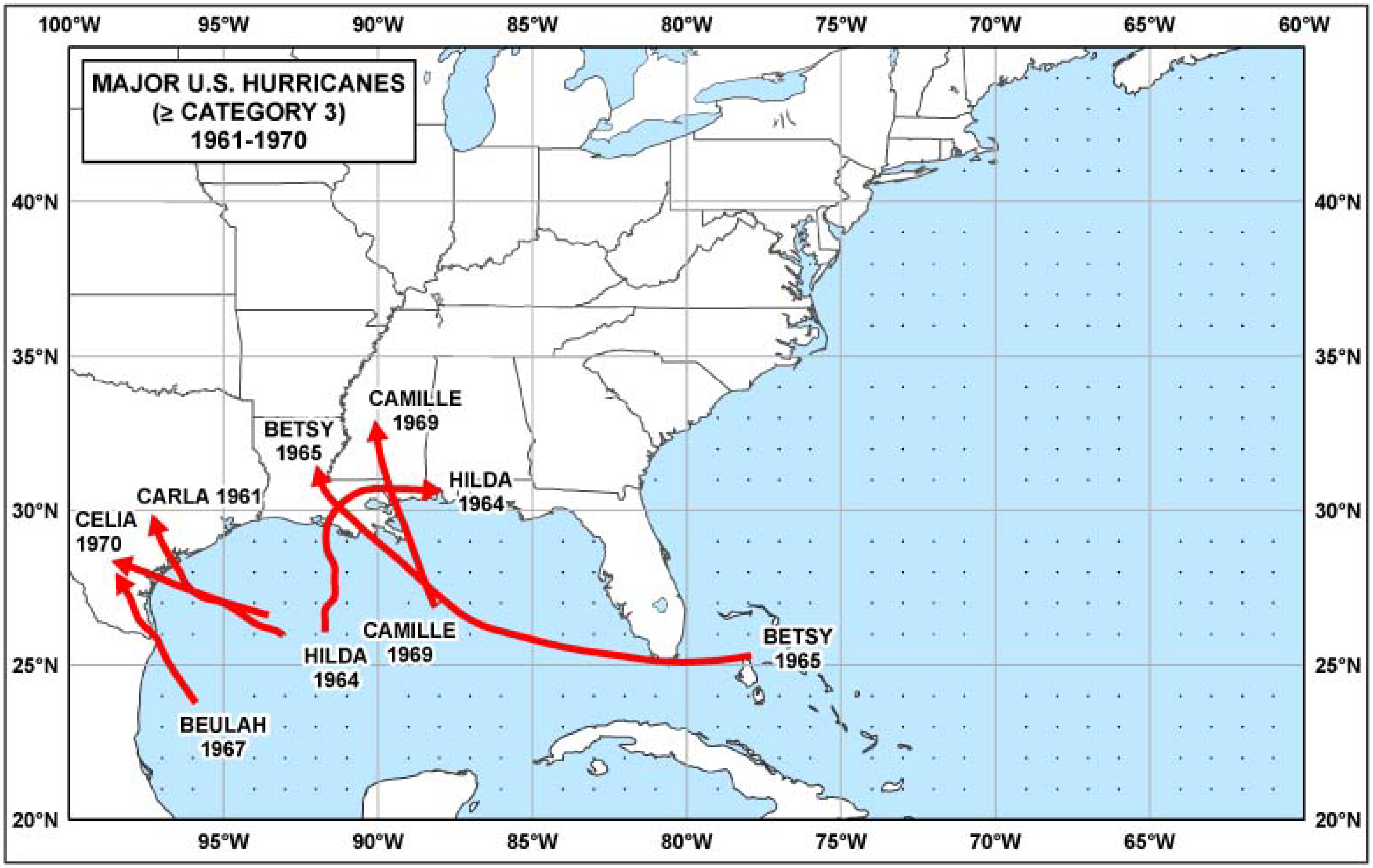

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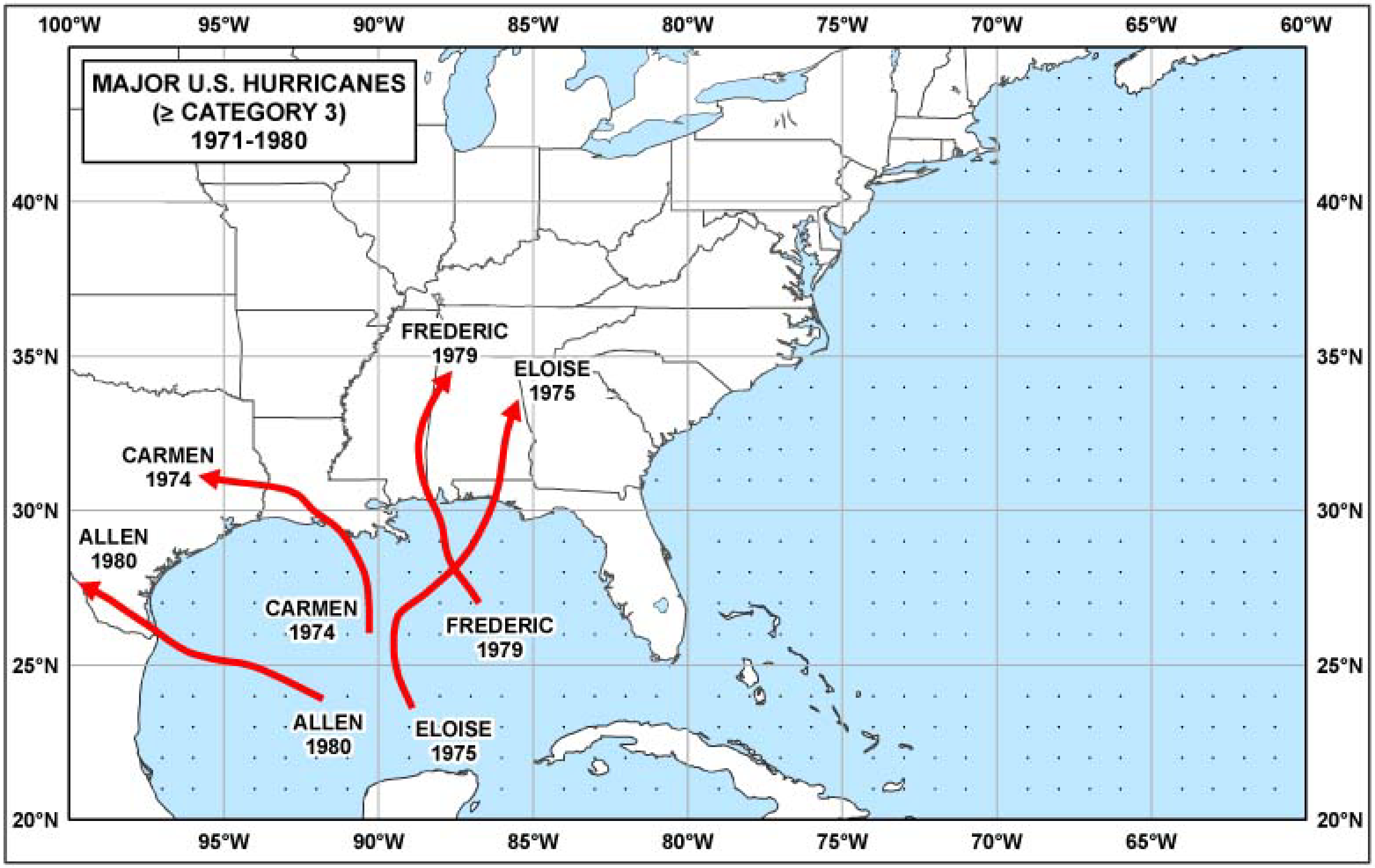

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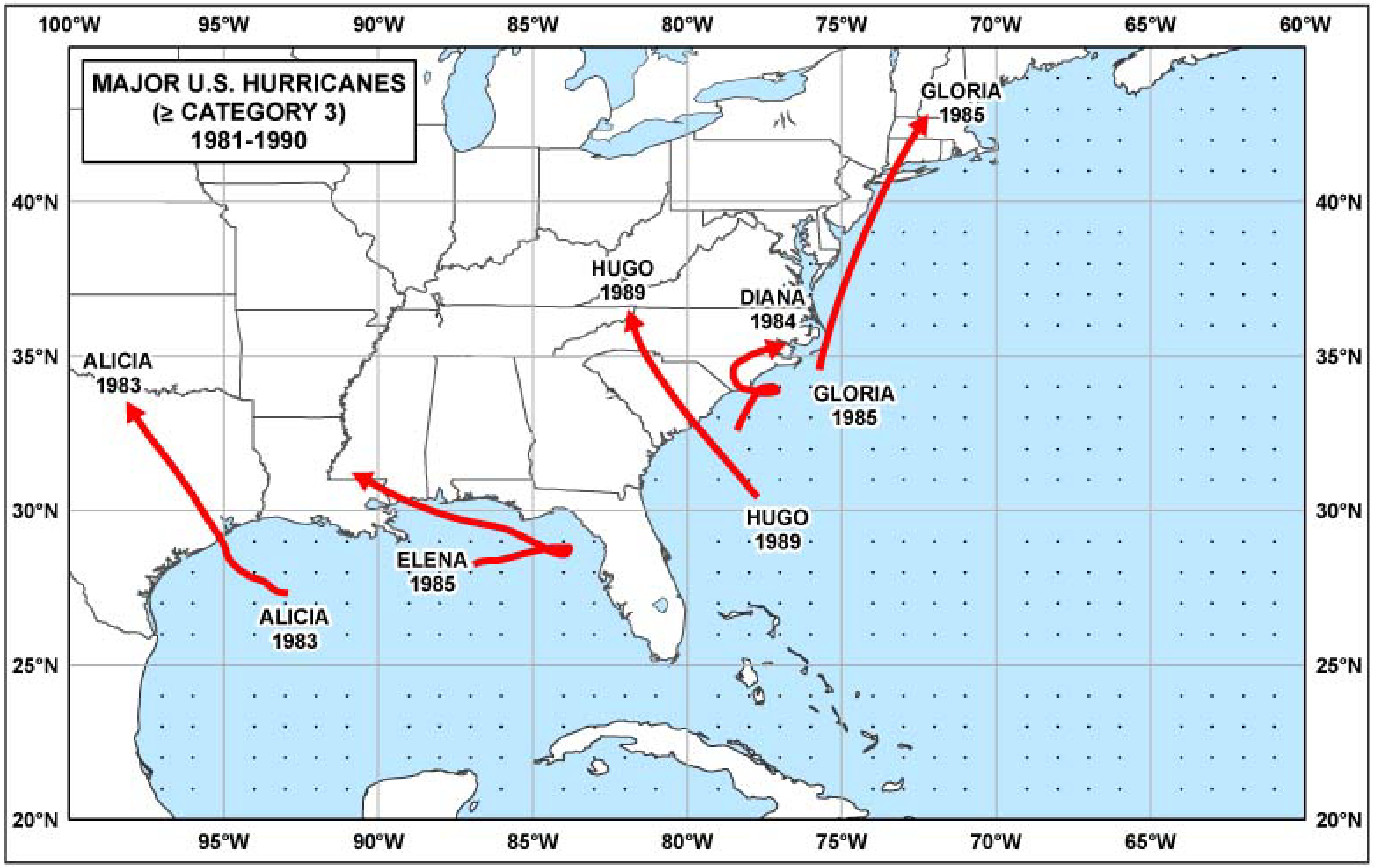
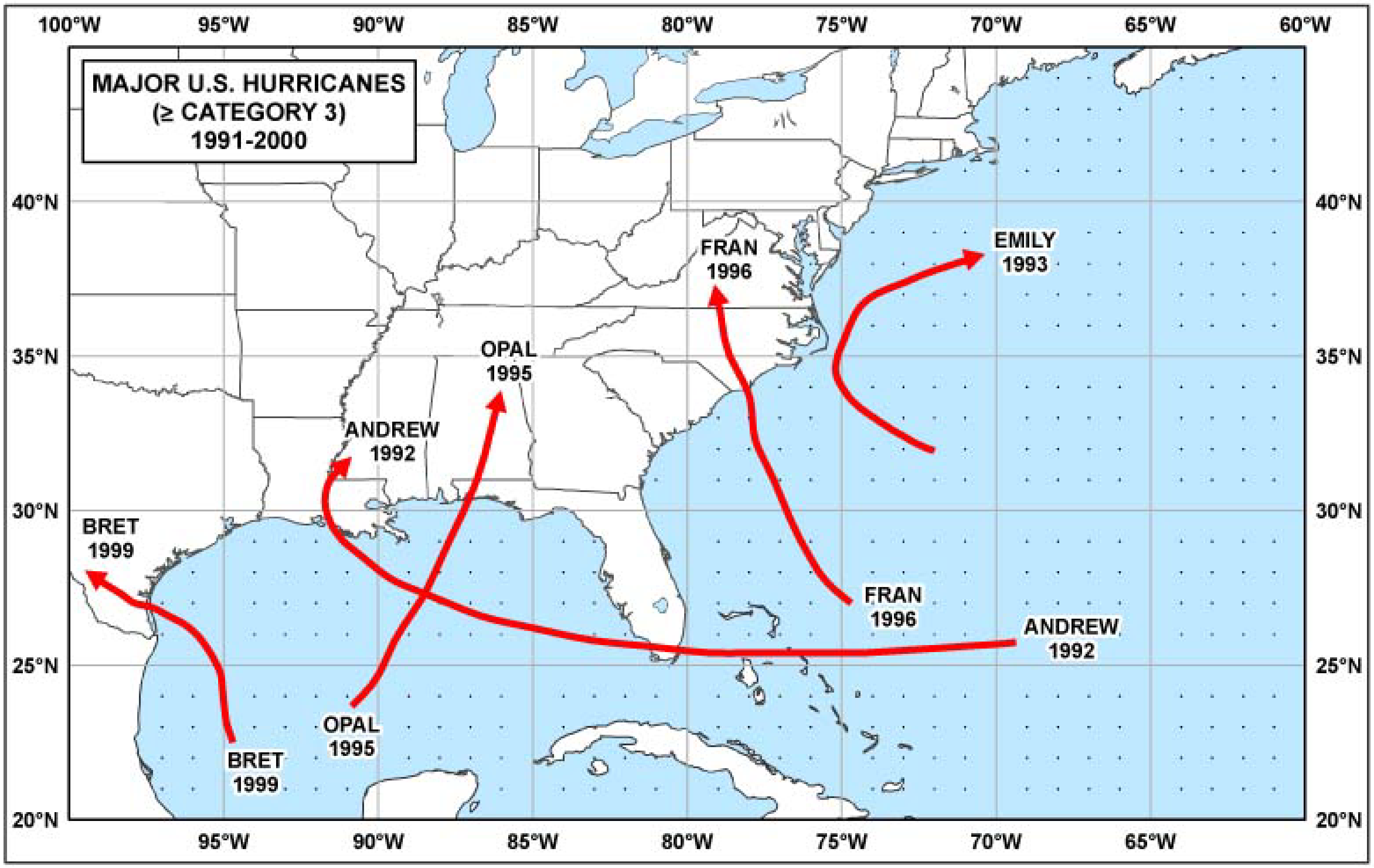


Figure 14. Landfalling United States major hurricanes (stronger than or equal to a category 3) during the period 1981-1990.



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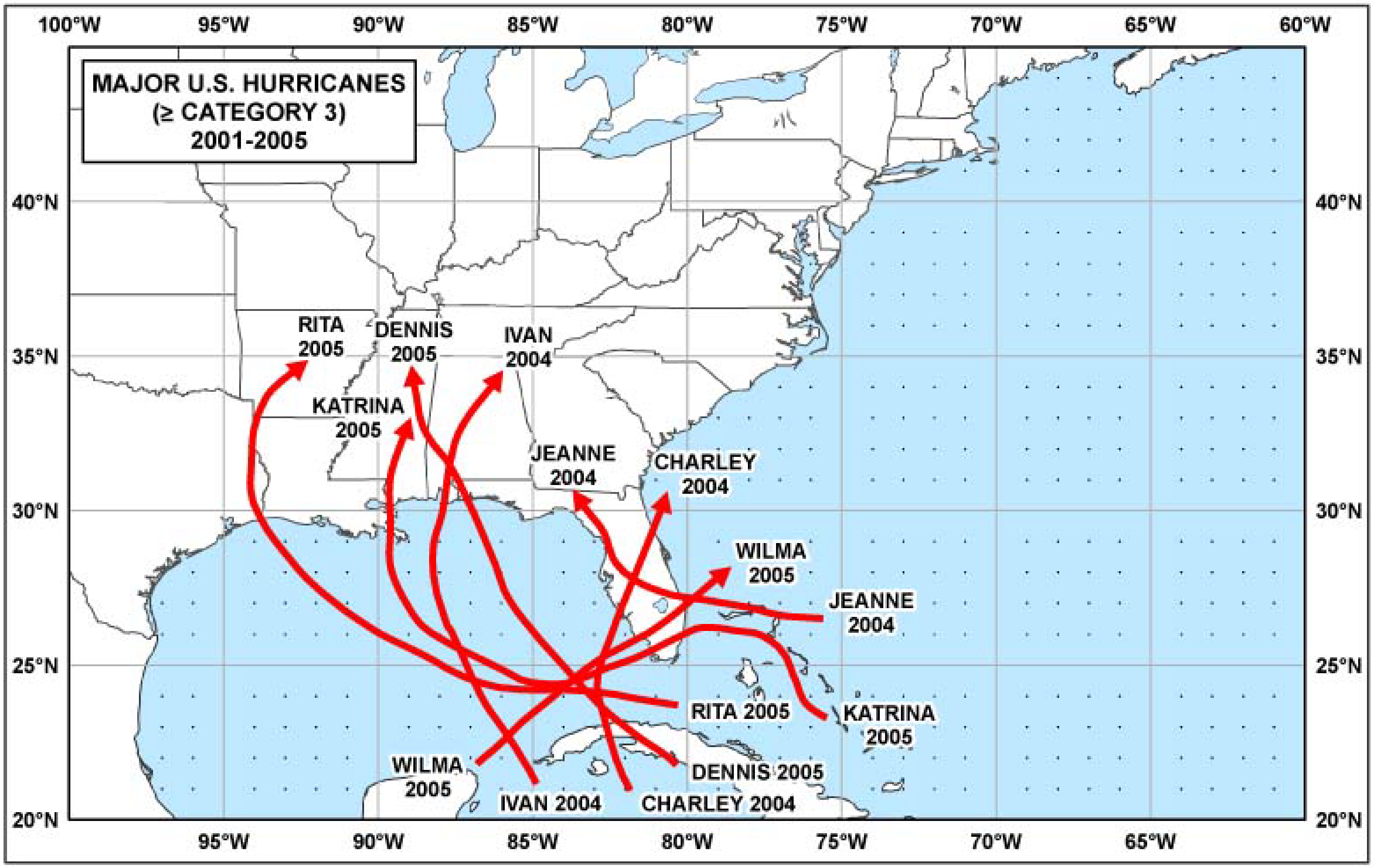

Figure 16. Landfalling United States major hurricanes (stronger than or equal to a category 3) during the period 2001-2005.

2. Hurricane Landfalls Compared with the Reserve Amount

SCE&G's Storm Reserve exposure to hurricane is illustrated, by landfalls of Category 3 and 4 events along the coast.

The landfall locations are at mileposts from about 1900 to 2050 at 10 mile intervals illustrated in Figure 17 below

The 46.8% of the frequency-weighted average damage was computed from all stochastic hurricanes at a given milepost.

The current Reserve amount is also shown superimposed on Figures 18 through 19 as a red dashed line and shows that the current Reserve has adequate reserve for some, but not all, Category 3 single hurricane damage values.

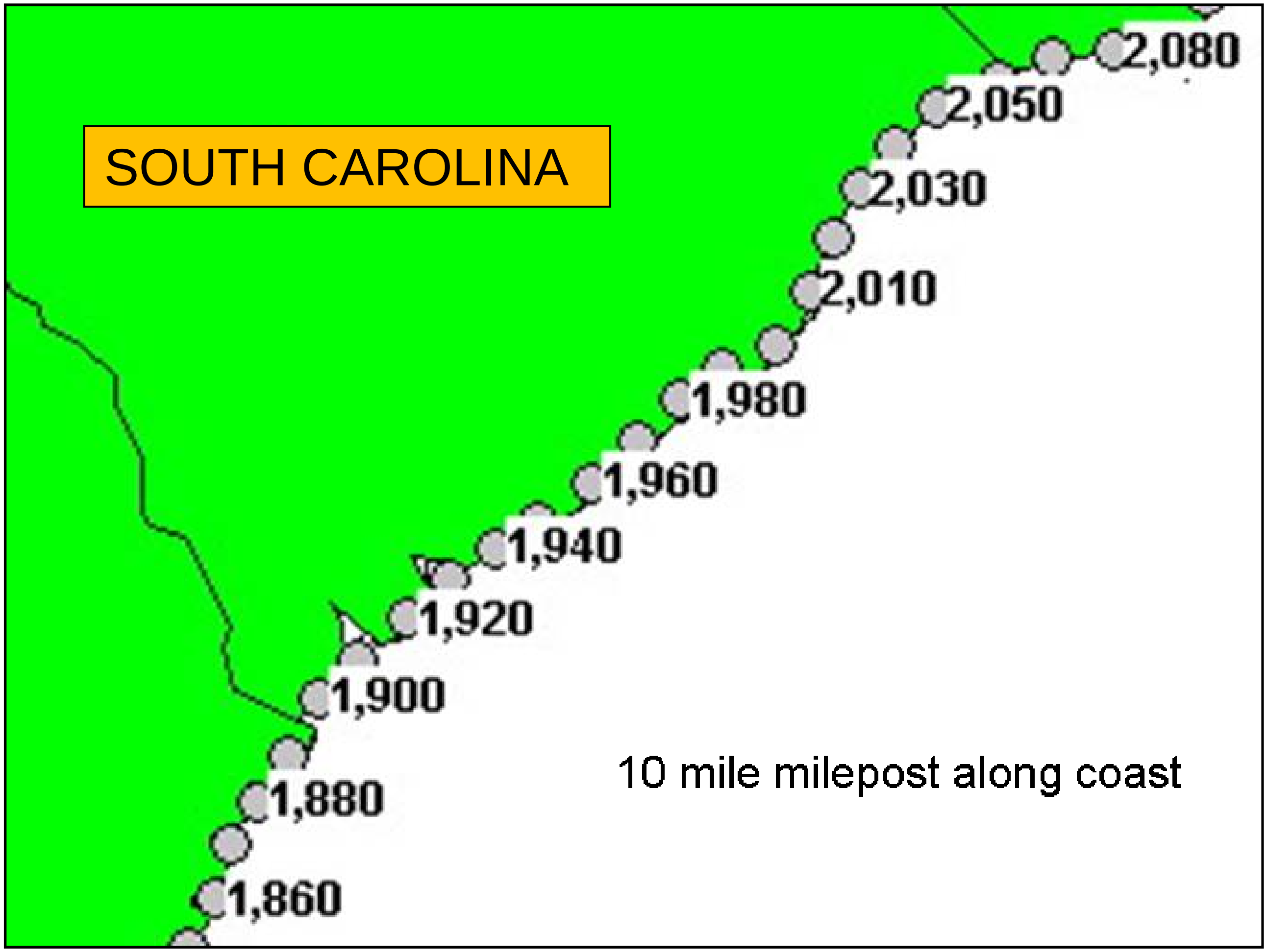

Figure 17: Hurricane Landfall Milepost

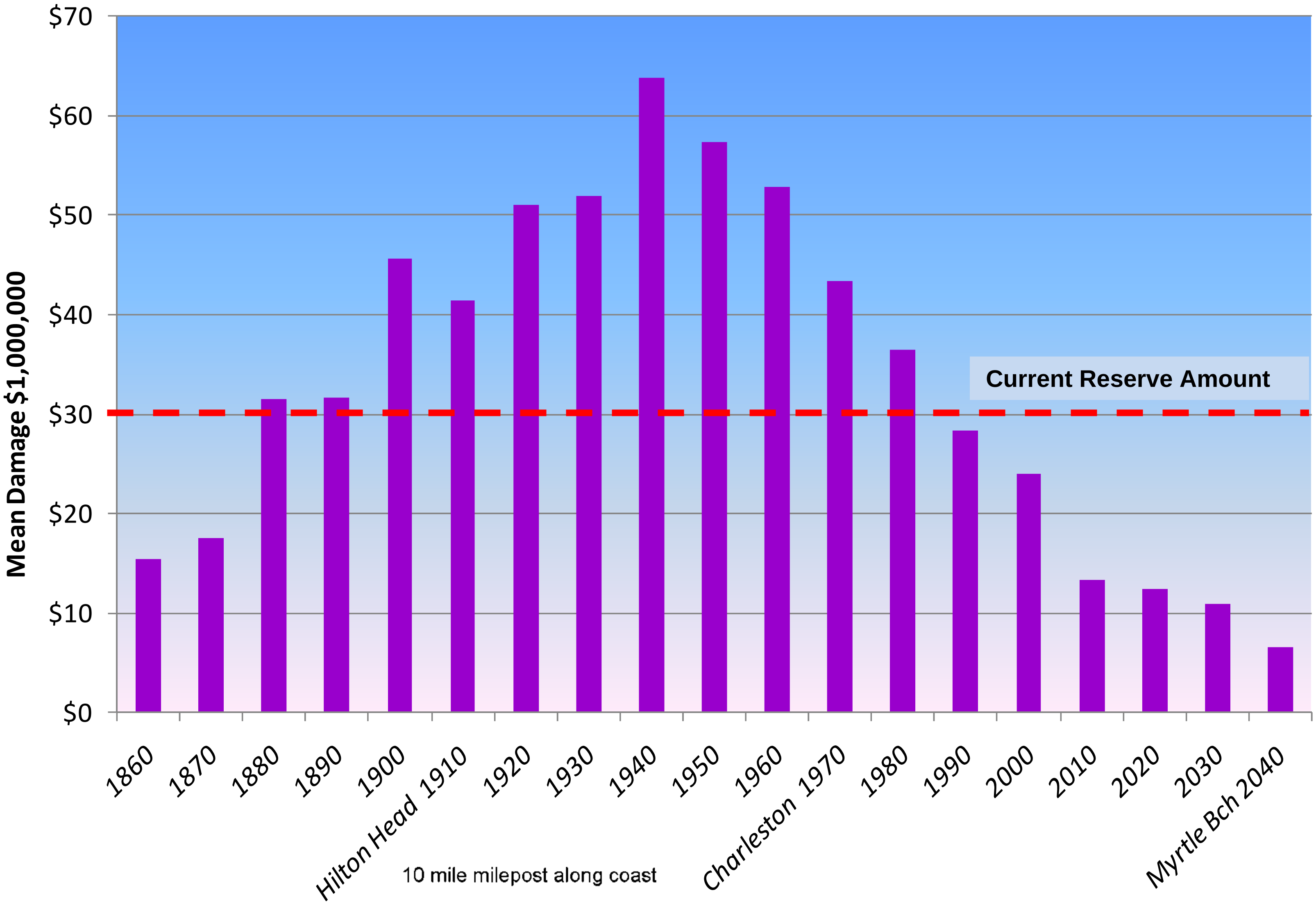

Figure 18: 46.8% Frequency Weighted Average Transmission & Distribution Damage from Single SSI 3 Landfalls

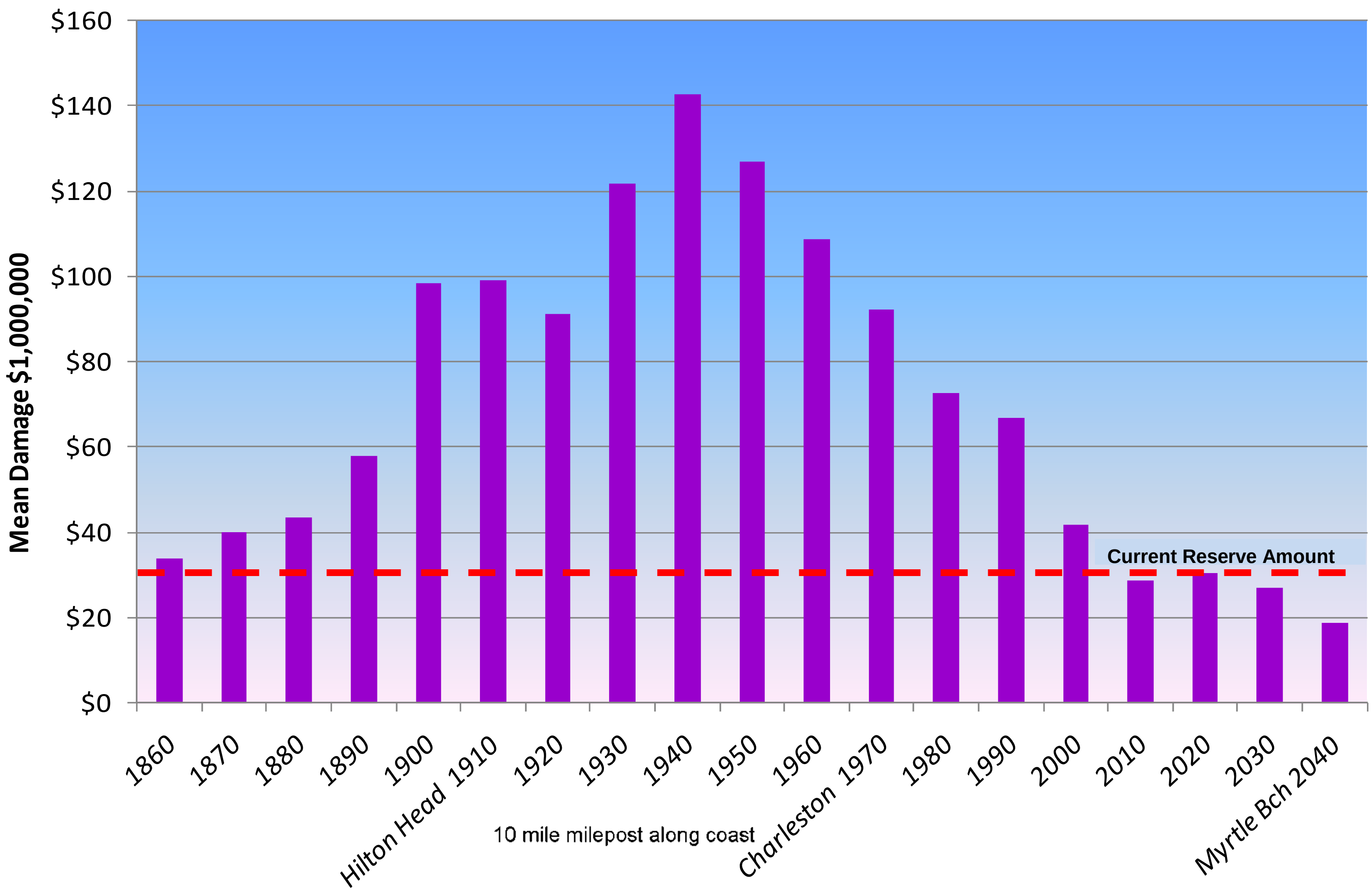

Figure 19: 46.8% of Frequency Weighted Average Transmission & Distribution Damage from Single SSI 4 Landfalls

3. Reserve Performance Analysis

Two Alternative Reserve Policy Cases

1) Current Reserve Amount & Policies:

Staring Reserve Amount $30.1 million

No annual contribution

$70 million insurance in excess of $100 million damage

Approximately $7 million Expected Annual Damage against the Reserve

Reserve loss grow at 5% per year to reflect system growth and asset value inflation

2) Current Reserve Amount & Policies with the Addition of $6.05 million annual contribution:

Staring Reserve Amount $30.1 million

$6.05 million annual contribution

$70 million insurance in excess of $100 million damage

Approximately $7 million Expected Annual Damage against the Reserve

Reserve loss grow at 5% per year to reflect system growth and asset value inflation

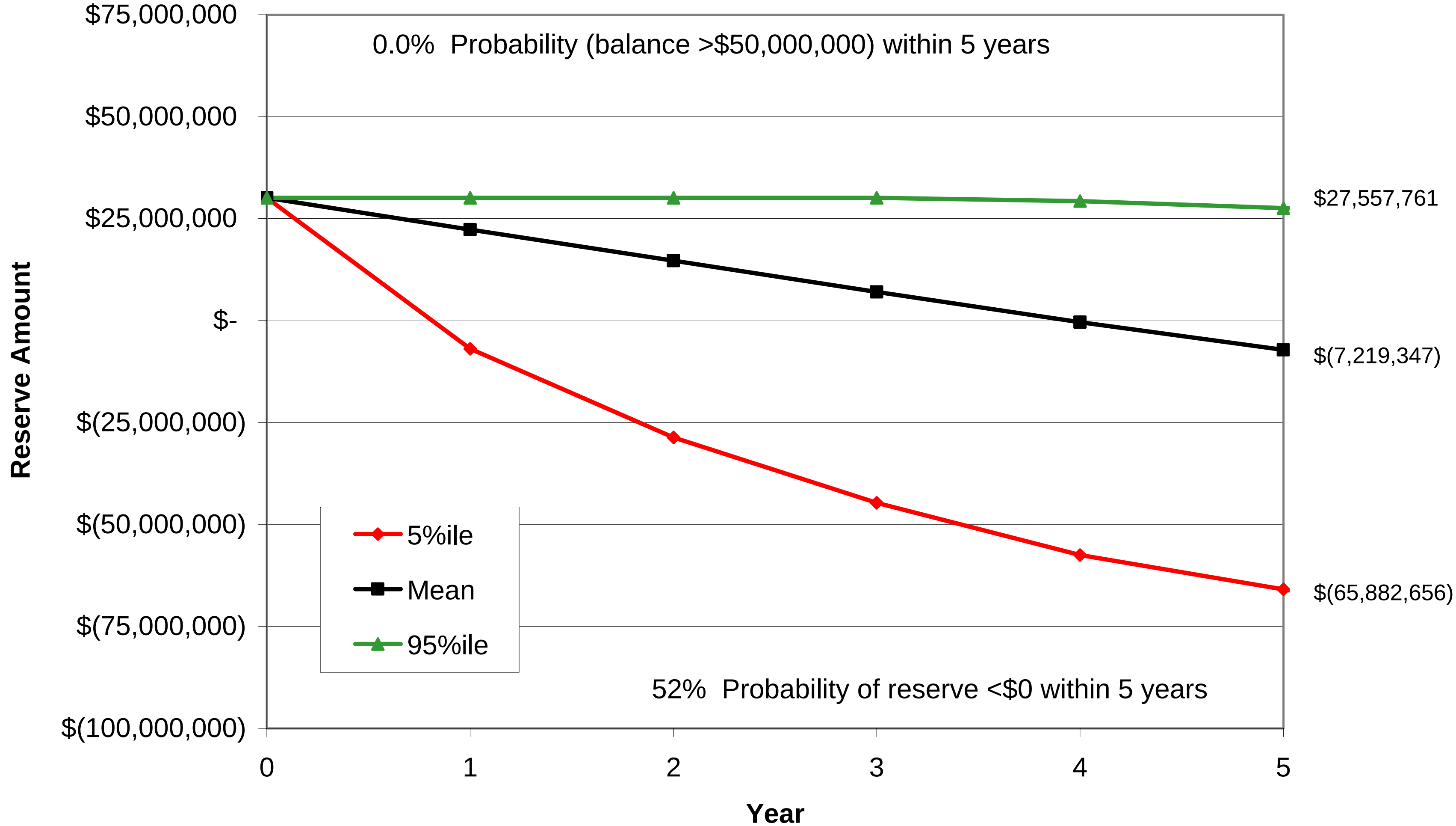

Figure 19: Reserve Performance Analysis: No Annual Contribution, $70 million insurance,, 5 year recovery

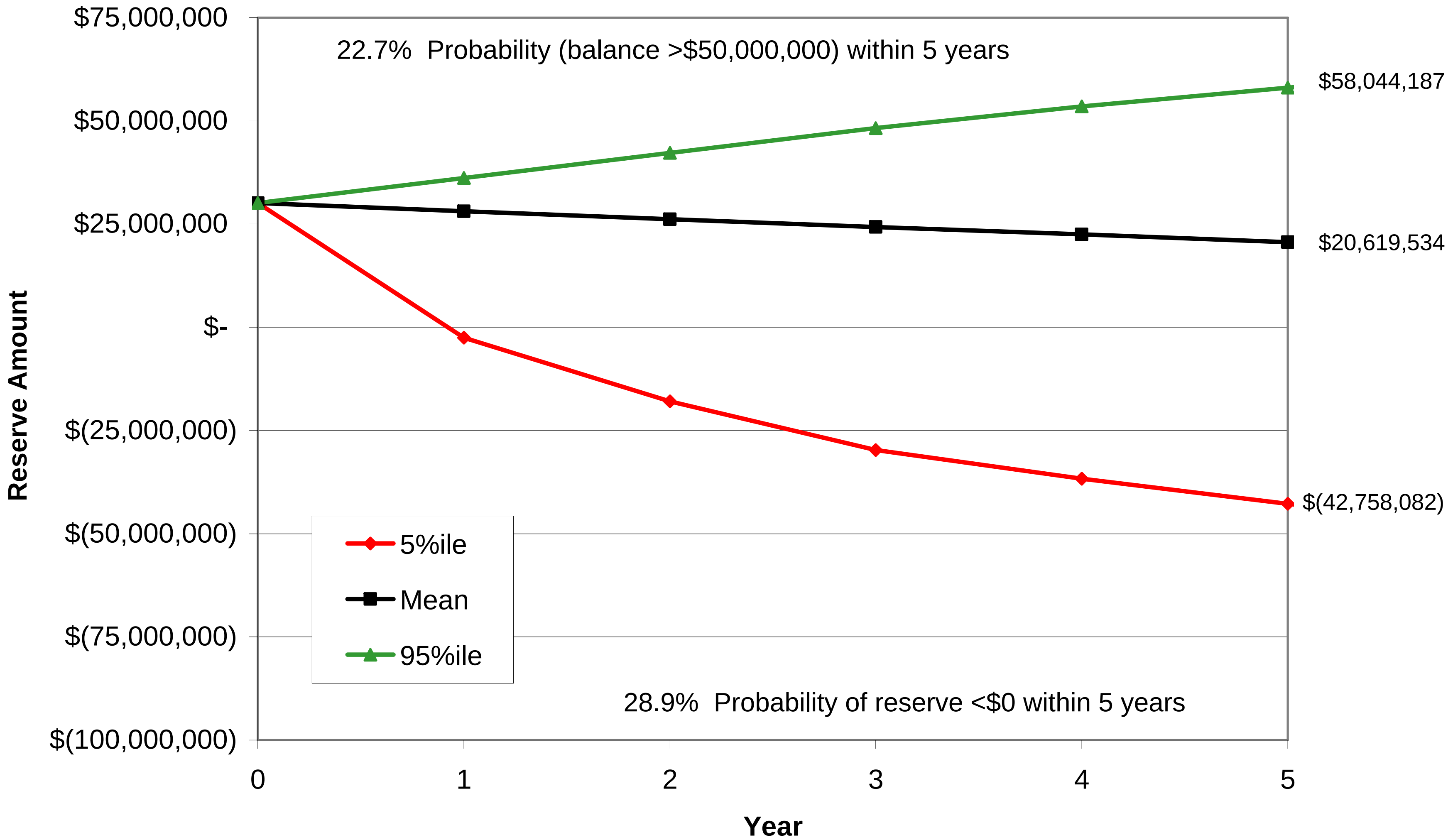

Figure 20: Reserve Performance Analysis: $6.05 million Annual Contribution, $70 million insurance, 5 year recovery

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